An evaluation of the impact on disadvantaged children's literacy of the Headsprout Early Reading program and the ability of schools to run the program independently.

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I confirm that the word count of this thesis is less than 100,000 words.

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Summary

The research within this thesis centred on the impact of an evidence-based literacy intervention in comparison to teaching as usual methods for primary school children in N. Ireland. These children were considered disadvantaged based on their receipt of free school meals and struggling with literacy based on school assessments. The literacy intervention was the online Headsprout Early Reading™ program, designed to teach literacy via a phonics based approach over 80, 30 minute episodes. Chapter 1 examines the impact of poverty on life and specifically literacy, the impact of budget cuts on school, the use of technology and evidence-based practice in education, how children are taught to read and an overview of the Headsprout literacy program.

Chapter 2 (Study 1) evaluated the impact of the Headsprout program on disadvantaged pupils in comparison to teaching as usual methods (n=123) within eight schools. Sentence reading age, phonics reading age and phonics fluency identification ability were assessed for all pupils at three time points during the research. Differences in pupil performance were analysed by statistical analysis to assess significance. The results demonstrated that use of HER improved performance on all measures significantly more than pupils receiving teaching as usual. Pupils using Headsprout made substantially larger gains on standardised reading assessments than pupil receiving teaching as usual.

Chapter 3 (Study 2) evaluated schools' ability to use the Headsprout program independently with existing resources. Weekly time in use measures were tracked for the duration of the research. These results were analysed to identify between school and between month differences in use. The results indicate that although schools were able to use the program for the duration of the research, progress and completion rates differed between schools and slowed for all schools as the school year reached a conclusion.

Chapter 4 (Study 3) was a qualitative study to elicit feedback from teachers on the challenges of using Headsprout in schools. Results from a written questionnaire completed by all participating teachers indicated that although there was a high level of satisfaction on the positive impact on literacy performance and confidence, issues with technology and pressure on teacher's time limited the effectiveness of the program.

Chapter 5 discussed the implications of each study and their relevance to current literature and practice as well as limitations and recommendations for relevant future research in this area.

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Conference presentations

Better Reading for Better Outcomes: Impact of Headsprout Early Reading on Literacy of Disadvantaged Primary School Children in Northern Ireland. Applied Behaviour Analysis International (ABAI) Washington, 2020 (Oral presentation).

Better Reading for Better Outcomes: Impact of Headsprout Early Reading on Literacy of Disadvantaged Primary School Children in Northern Ireland. Division of Behaviour Analysis (DBA), Trinity College, Dublin, 2019.

Better Reading for Better Outcomes: Impact of Headsprout Early Reading on Literacy of Disadvantaged Primary School Children in Northern Ireland. Division of Behaviour Analysis (DBA), Galway, 2018.

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Chapter 1:

Learning to read; the impact of poverty, teaching strategies, technology and science.

1.1 UK poverty

The World Bank, 2015 established an absolute minimum international poverty rate of $1.90 per day based on person's daily consumption designed to capture those people living in the most extreme poverty globally. As of 2015, 10% of the world population lived below this rate. A further 65% were living on less than $10 per day (Roser and Ortiz-Ospina, 2020). In global terms, great improvements have been made to reduce the number of people living in poverty. In 1990, 35% of the world population (approximately 2 billion) lived below this global poverty line. This had dropped to 10.7% (approximately 767 million) by 2013 (World Bank, 2016; United Nations, 2016). Concern Worldwide (2017) claimed half those people could be removed from poverty if they were able to complete secondary school. 264 million children were unable to attend school in 2015 with 61 million of those children at primary school age. Based on this trend, 17 million young children will never attend school in their lifetime (United Nations Human Development Report, 2016). In the EU, people are considered at risk of monetary poverty when their equivalised disposable income (the money left after all bills, divided by the number of household members after social transfers and benefits) is below the at-risk-of-poverty threshold. This is set at 60 % of the national median equivalised disposable income. 23.7% of people in the EU suffered from either monetary poverty, severe material deprivation or very low work intensity. 31.3 % of young people aged 18 to 24 and 26.9 % of those aged less than 18 were at risk of poverty or social exclusion. 66% of unemployed people faced the risk of poverty or social exclusion, almost 50 % of all single parents were at risk of poverty or social exclusion and 34.7 % of adults with only lower secondary educational attainment were at risk of poverty or social exclusion. Along with economic, tax and employment policies, the EU identified education as one of the main bulwarks against the impact of poverty (Eurostat, 2020).

In the UK the poverty line is set at 60% of the average national income, which in 2019 equates to £43.45 per day (Department for Work and Pensions, 2019). In relative terms, the UK had a lower percentage of people living in poverty and/or social exclusion than the European average. The UK Office for National Statistics (2015), reported 7.8% of the UK population were experiencing persistent poverty, being in relative income poverty in the current year and at least two of the three preceding years, equivalent to roughly 4.6 million people. Of the 28 EU countries, the UK had the fifth lowest rate of persistent poverty (7.3%) and the 13th highest poverty rate of 16.7%, the EU average was 17.3%. From 2012 to 2015, roughly 30% of the population were at risk of poverty for at least 1 year. The UK had the largest proportion of individuals who were in poverty for just 1 year (59.9%) and the smallest proportion who were in poverty for all 4 years (10.5%). The UK has one of the lowest poverty to persistent poverty ratios, with more individuals who experienced 1 or 2 years of poverty rather than 3 or 4 years of poverty between 2012 and 2015. Almost 3 in 10 persistently poor individuals couldn't afford four or more essential items in 2015, the UK's severe material deprivation rate was 6.1%. In 2015, 7.6% of children lived with persistent poverty, children with a single parent caring for them had a persistent poverty rate 15% higher than children with two parents caring for them (5% vs 20%). Children without any formal qualification (below GCSE level) were most at risk of persistent poverty. Two-thirds of children in poverty live in households with at least one person in employment. The UK had the biggest reduction in child poverty in the EU between 1990 and 2010 although the low income and material deprivation rates have increase in the UK since the global recession of 2010. In 2019 based on households below average income, Wales has consistently the highest rate of poverty in the UK at 23%. Scotland and N. Ireland have the lowest rate at 19% while England has 22% of households below average income. Although N. Ireland registers the joint lowest percentage in 2019, this is an increase from 16% in 2016. Additionally, N.

Ireland recorded a child poverty rate of 25% in 2019 in comparison to Wales 28%, England 31% and Scotland 24% (Joseph Rowntree Foundation, 2019). 16% of the population of N. Ireland (approx. 292,000) were living in relative poverty defined as living on less than 60% of the average income. 14% of the population were considered to be living in absolute poverty (249,000). 19% of children (85,000) are estimated to live in relative poverty, 16% in absolute poverty and 7% in material deprivation. Although children are at a higher risk of living in relative and absolute poverty than the overall N. Ireland population, the percentage fell from 25% in 2015 to 19% in 2018 (Department for Communities, 2018).

1.2 Free School Meals Eligibility

Free school meal eligibility (FSME) is often used as an indicator of family income in educational research in the UK (Strand, 1999; Hobbs & Vignoles, 2010). Although the application process for FSME differs for the four parts of the UK, the eligibility criteria are broadly similar: a child may qualify if they have a parent in receipt of Income Support, Income-based Jobseekers Allowance, Income Related Employment and Support Allowance, State Pension Credit and Child Tax/Working Tax creditor or Universal Credit. Data for children eligible for free school meals (FSM) is based on those who are both eligible and are claiming FSM; those who are eligible but not claiming are not included in the data (Hobbs & Vignoles, 2010). In N. Ireland, 99,142 pupils (29.3%) were entitled to FSM in 2019. Of those eligible, 80,206 pupils (80.9%) took a FSM. 18,936 pupils who were entitled to FSM didn't use them. Primary school pupils had the lowest uptake of FSM at 60.4% compared to nursery at 93.6%. Pupils from the least affluent schools (when using FSME as an indicator) were most likely to use FSM (Department of Education, 2019).

Using FSME as an indicator of disadvantage has been critised because it is a black and white, inconsistent measure that does not always distinguish well between levels of disadvantage. Croxford, (2000) suggests there is potentially very little difference in disadvantage between

those on either side of the threshold while Long and Bolton (2014) claim the qualifying benefits for FSME are mainly out of work benefits so it does not suitably cover the 'working poor' such as those working on zero hour contracts. Furthermore, Shuttleworth (1995) argues that when used alone, FSME is not the optimal indicator of a family's socio-economic status. However, proponents of FMSE as an indicator of socio-economic disadvantage (Ilie, Sutherland & Vignoles, 2017; Taylor, 2018) suggest although imperfect, FSME captures more of this group than any other measure currently available. Not all families eligible for FSM claim them. The DfE has estimated that around 14% of pupils who are entitled do not claimed FSM. This rate is thought to be higher among older pupils and those in less deprived areas. The importance of FSM to families suffering from poverty was highlighted by the Covid-19 pandemic that closed all UK schools in March 2020. In response, the N. Ireland executive legislated to ensure the funding normally paid to schools to provide FSM was instead paid directly to parents of the eligible children eligible for the duration of school closures. This decision was made to counteract the added financial pressure of having children at home and having to supply meals that would normally be received at school.

The FSME indicator is an important factor in UK school funding. In England, schools receive a pupil premium of £1320 per pupil per year for each pupil who has been registered for FSM at any time in the last 6 years (known as 'Ever 6 FSM' pupils). This is aimed at improving the attainment of disadvantaged children. In N. Ireland since 2005, the equivalent funding is called the Common Funding Scheme (CFS). An independent review of this CFS in 2012 found it was outdated, overly complicated and did not help pupils in the way it was intended; funding is not funnelled according to the needs of individual pupils, more toward the needs of the school (Salisbury, 2013). Changes to the CFS based on Salisbury's report resulted in a common funding formula based on the *number* of pupils eligible for FSME and the *percentage* of total pupils eligible for FSM in each school. This created 3 bands of pupil

funding (Band A: £613.60, Band B: 767.00, Band C: £1227.00) which aims to funnel funding towards children from disadvantaged background. School are expected to spend the funding on delivering all aspects of the curriculum to pupils (Department of Education, 2019). However, at the time of its introduction, both the Northern Ireland Human Rights Commission (NIHRC, 2013) and the Irish National Teachers Organisation (INTO, 2013) criticised the CFS bands claiming it would result in budget cuts for 80% of schools based on the new formula. Additionally, the NIRHC was concerned at the lack of outcome-based monitoring and suggested the Department of Education should make provision for robust accountability in the use of funds to measure impact on the delivery of effective education. As of 2020 no direct measurement of the impact of CFS exists.

A Northern Ireland Affairs Committee report (2019) into the education budget and school funding in N. Ireland, six years after the INTO and NIHRC expressed their concerns, found ongoing consternation with the CFS. Many contributors to the review said a complete review of the CFS was required with the N. Ireland Audit Office, recommending a fundamental review of school funding arrangements. Disparity in funding was identified; small schools in affluent areas which were receiving up to £14,200 per pupil compared to £3000 per pupil for schools in socio-economically deprived areas. Additionally, primary schools felt they didn't receive the funding that secondary schools did; schools can receive £1300 more for first year in post primary than last year in primary. Schools with a lower number of FSME pupils felt they were underfunded with more funds going to high FSME eligible pupils at their expense. One participating principal told the report authors that planning was very difficult because of the fact budgets changed on an annual basis; in his school a 2% change in the proportion of FSME pupils could result in a budget reduction of £180,000 within one year.

1.3 Impact of poverty: Economy, health and education

Economy and health

The economic cost of poverty has been estimated at between 4-5% of GDP. As an example, in the US that equates to approximately $1 trillion (Peterson Foundation, 2015). In the UK, the figure is between £70-80 billion annually (Holzer, Schanzenbach, Duncan & Ludwig, 2007; Bramley, Hirsch, Littlewood & Watkins 2016; McLaughlin & Rank, 2018). People living with economic disadvantage suffer disproportionately worse health implications throughout their life. Babies born in economically disadvantaged areas of the UK weigh on average 200 grams less than those in wealthier areas, they have higher risk of death in the first year and are more likely to suffer childhood obesity leading to morbidity and higher rates of mortality in later life (Reilly et al, 2003; Adamson et al, 2007). People living with economic disadvantage also suffer from higher levels of drug and alcohol abuse, injuries and violence (Bambra, Joyce, and Maryon-Davies, 2009; British Medical Association, 2017), lower levels of cognitive development and increased mental health issues (Fryers, Jenkins & Melzer, 2004) and various chronic adult health conditions leading to old age including higher degrees of mobility problems (Craig & Mindell, 2007). Indeed, most individual long-term conditions are twice as likely to occur in people from lower socio-economic groups. Chronic conditions such as cardiovascular disease and cancer, the two main causes of death in the UK, disproportionally afflict those living in poverty: there are 2.7 more deaths from cardiovascular disease in men from the most deprived regions of the UK compared to those in the least deprived (Allender et al, 2008). Additionally, poverty is associated with unemployment, increased alcohol and drug abuse, poorer living conditions and increased levels of stress leading to increased mental health issues (British Medical Association, 2009). The fact that poverty has a detrimental impact on physical and mental health mean outbreaks such as the 2020 Covid-19 pandemic will have a disproportionally bigger impact on those living in poverty than those not: people with existing underlying conditions such as heart

disease are at a higher risk of complication from the virus. (Centre for Disease Control and Prevention, 2020). The impact on physical and mental health has resulted in death rates from every disease and at every age, being higher in areas of economic disadvantage. Additionally, life expectancy at birth in the UK is consistently lower in deprived communities at 78.8 years compared to 86.7 for females and 74 to 83.8 for males. This gap in life expectancy has increased from 2001-2016 from 6.1 to 7.9 years average in females and 9 to 9.7 years in males (Bennett et al, 2018). Smoking accounts for around half the difference in life expectancy between the lowest and highest income groups, and smoking-related death rates are two to three times higher among disadvantaged social groups than among the better off (Allender et al., 2008; Shahab, Jarvis, Britton, & West 2006).

The economic crash of 2009 led to the implementation of economic austerity in the UK. This resulted in benefits being frozen from 2015-2020, a transition to universal credit, which bundles all available benefits into one package, and the child element of tax credits being limited at the first two children. These will contribute to increases in inequality, poverty and a significant increase in child poverty between 2018-2022 (Institute for Fiscal Studies, 2018). Official measurement of deprivation in N. Ireland comes from The N. Ireland Statistics and Research Agency (NISRA, 2017) who use seven measurement indicators: Income, Employment, Health and Disability, Education Skills and Training, Access to Services, Living Environment and Crime and Disorder. Within the 100 most deprived areas of N. Ireland, 50 are in Belfast City Council area and 20 are in Derry City and Strabane Council area; Belfast and Derry City and Strabane council areas accounted for all the top 10 most deprived areas. Within Derry City and Strabane council areas, disadvantage has the same impact as the rest of the UK; the average life expectancy for males is 76.5 compared to the NI average of 78.1, the average life expectancy for females is 80.7 compared to the NI average of 82.4.

Clearly, economic disadvantage has serious health implications. Educationally, the case is very similar.

Poverty and Education

Poverty has a detrimental impact on early years learning. By the time children from low income families start school, they can be up to 19 months behind middle-income children in cognitive skills (Waldfogel and Washbrook, 2011). Poverty has a negative impact on how children view school and the level of educational attainment achieved. Research into the impact of poverty on young children's experience of school (Horgan, 2007; Ridge, 2002) has identified how most children's experience of school is determined by the level of disadvantage they face. Poorer children accept that they are not going to get the same quality of schooling, or the same outcomes, as better-off children. They also cite negative reasons for the importance of school such as avoiding problems in adult life; wealthier children tend to cite more positive reasons such as increased opportunities of good employment and a good life as an adult. School attendance is also negatively impacted by poverty. Absence rates for UK pupils who are eligible for free school meals was 7.6% in 2018. This compared to 4.3% for non-free school meals pupils. The persistent absence rate (23.6%) was more than double for free school meal pupils than non-free school meal pupils (Department of Education, 2019). Disadvantage through poverty impacts on attendance for many reasons: Inability to afford travel costs, poor diet impacting health, lack of clothes, lack of sleep because of overcrowding, bullying, the level of parental education (Gee, 2018; Thompson, 2020). Poor attendance impacts on educational attainment; 44% of UK pupils in 2003 with no absence in Key Stage 4 achieved the English Baccalaureate, this fell to 32% for pupils who missed 14 days of lessons and again to 16% for those who missed up to 28 days while studying for GCSEs. Pupils with the best attendance were 4 times more likely to achieve 5 GCSEs and 3

times as likely to achieve an A* than pupils with the highest level of absences. Similarly, primary school pupils with the best attendance were 1.5 times more likely to achieve Key Stage 2 Level 4 and 4.5 times more likely to achieve Key Stage 2 Level 5 than pupils with the highest level of absences (Zhang, 2015)

In a 2018 National Education Union poll of over one thousand primary school teachers on the impact of poverty, a wide range of consequences of poverty were observed including increased absences from school (83%), increased behavioural issues (85%), loss of concentration (81%), poorer health (59%), increased lateness to school (79%), unsuitable clothing being worn 63%, increased hunger 46% and pupil living in unsuitable and/or temporary accommodation (46%). Intergenerational poverty also impacts on attitudes to education. People who endured poverty while at school are less likely to have a positive attitude to the benefits of education with their own children. Conversely, mothers who believe they can make a difference to educating their children by getting involved in their learning, who wish their children stay in education beyond the age of 16 and found school valuable themselves had a positive impact on the academic performance of their children (Joseph Rowntree Foundation, 2019). Children's attitudes to education can improve performance if they believe in their own ability, believe school is important, don't get involved in anti-social behaviour, don't suffer from behaviour problems and haven't experienced bullying. However, children from poorer families are less likely to have these experiences than children from richer families and tend to suffer from a lowering of expectations (Attree, 2006).

Children growing up in poverty perform worse in vocabulary development, reading and numeracy than those not living in poverty throughout school (Finnegan, Minogue, Telfer, Kelly &Warren, 2016). This gap in performance increases throughout school years. In 2010,

only 21% of the poorest 20% of UK pupils managed to gain 5 GCSE from A-C compared to 75% of the top 20%, a 54% percentage difference (Goodman & Gregg, 2010). This attainment gap maintained to 2019 with poorer pupils performing significantly worse in all GSCE subjects than their wealthier peers with only 11% of the poorest pupils achieving top grades in Maths, English, Geography and French. 50% of the poorest pupils failed to achieve a standard pass compared to 27% of wealthier pupils (Teach First, 2019).

The reform of GSCEs in 2017 by the Secretary of State for Education which changed the content, structure, assessment, grading and tiering system of GCSE's with an emphasis on greater rigour in testing, has added to the inequality gap. Wealthier pupils are now 3.37 times more likely to achieve the highest grade and 1.63 times more likely to achieve a median grade than economically disadvantaged peers. Before the reforms, this figure was 3.26 and 1.42, which is a statistically significant difference (Burgess and Thompson, 2019). Making the exams more difficult to pass will impact disproportionally those pupils already less likely to pass.

In terms of academic performance, pupils in N. Ireland outperform their counterparts in England and Wales at GCSE level (Scotland uses Scottish National Qualifications set by the Scottish Qualification Authority so direct comparison is not possible). N. Ireland pupils consistently achieved more A/Grade 7 or above as well as a higher percentage of A-C grades. N. Ireland pupils also has the highest percentage of pupils achieving a C/Grade 4 than their counterparts in England and Wales (National Association of Head Teachers, 2019). However, this apparent success masks a trend. Children eligible for free school meals underperformed compared to those pupils not eligible.

	2014	2018	Increase 2014-8
FSME: 5 A-C GSCE	34.9%	48.6%	13.7%
Non FMSE: 5 A-C GSCE	69.7%	78.1%	8.4%
Difference between FMSE and non FSME	**34.8%**	**29.5%**	**-5.3%**
FSME: 3 A Level A-C	16.6%	22%	5.4%
Non FSME: 3 A Level A-C	41.4%	47.1%	5.7%
Difference between FMSE and non FSME	**24.8%**	**25.1%**	**0.3%**
FSME: No Qualifications at 16	2%	1.3%	-0.7%
Non FSME: no qualifications at 16	0.5%	0.4%	-0.1%
Difference between FMSE and non FSME	**1.5%**	**0.9%**	**-0.6%**
FSME to Higher Education	19.5%	23.5%	4%
Non FSME to HE	46.7%	49.7%	3%
Difference between FMSE and non FSME	**27.2%**	**26.2%**	**-1%**
FSME to Further Education	42.3%	42.3%	Same
Non FSME to Further Education	33.9%	30.5%	-3.4%
Difference between FMSE and non FSME	**8.4%**	**11.8%**	**3.4%**
FSME to unemployment	4.8%	3.9%	-0.9%
Non FSME to unemployment	2.1%	1.5%	-0.6%
Difference	**2.7%**	**2.4%**	**-0.3%**

Table 1.1: Comparison of FMSE and Non FSME pupil outcomes from 2014-2018

Table 1.1 shows the number of FSME pupils in N. Ireland achieving 5 or more A-C grades including Maths and English at GCSE increased from 34.9% in 2014 to 48.6 (+13.7%) in 2018. However, the figures for non FSME pupils also increased during this period from 67.95 to 78.1% (+8.4%) Although the attainment gap reduced from 2014-2018, an attainment gap of 29.5% existed between the two groups. During the same period the percentage of FSME pupils achieving 3+ A-Level at grade A-C changed from 16.65 in 2014 to 22% (+5.4%) in 2018. However, the percentage for non FSME also increase from 41.4% to 47.1% (+5.7%); an increase in attainment gap from 24.8% to 25.1%.

Progression to higher education changed from 2014 to 2018 from 19.5% to 23.5% (+4%) for FSME vs 46.7% to 49.7% (+3%) for non FSME. Progress to further education didn't change from 2014-2018 for FSME staying at 42.3%. For non FSME it reduced from 33.9% to 30.5% (-3.4%). The percentage of FSME pupils becoming unemployed changed from 4.8% to 3.9% (- 0.9%). For non FSME it changed from 2.1% to 1.5% (-0.6%). The number of pupils leaving school with no formal qualifications changed from 2% to 1.3% for FSME pupils as opposed 0.5 % to 0.4% for non FSME pupils (Department of Education Statistical bulletins 5/2015 & 4/2019).

Although FSME pupil's educational attainment is improving, the gap between them and those not entitled to FSM still exists.

1.4 Poverty and literacy.

When you are poor you prioritise. Some people have books in their home environments throughout their life; buying books and reading is normal. For others, the cost of a £5 book equates to feeding their family for a day. Difficult choices are made and for many, books are low down the list of priority. Additionally, access to free books from libraries has become more difficult. In the UK more than 800 libraries (17%) have been closed since 2010 as

funding dropped by almost 30% (Chartered Institute of Public Finance & Accounting, 2019). Children growing up in homes with an environment containing books receive the equivalent of three years more schooling than children from homes without books. Furthermore, children who are read to three times a week are almost twice as likely to score in the top 25% in reading in comparison to those who are not (Denton & West, 2002). This literacy gap is one of the most damaging impacts of disadvantage on children (Clark and Foster, 2005; Clarke and Akerman, 2006). Poor literacy skills impinge on all aspects of education as it prevents access to learning materials associated with so much of the school curriculum; if you struggle to read or read at too slow a pace it is very difficult to learn. Learning environments incorporate more and varied stimulus than ever before via multimedia and Information and Communication Technology (ICT). However, use of the written word is still the dominant method of teaching literacy. Challenging home environments add to the difficulties disadvantaged children face; smoking, alcohol abuse, banging doors, violence, absent parents, loud music, televisions in each room, lack of food, poor sleeping patterns and overcrowding make completing homework an impossibility for many (Kellett & Dar, 2007). Additionally, many adults who have lived throughout disadvantage and poor literacy tend to communicate their own negative experience of literacy and schooling to their own children which perpetuates and intergenerational cycle of illiteracy (Hanemann, 2015).

Kirsch et al. (2003) identified improvements in literacy as a key tool in social improvement for people living in poverty and that poor literacy is not irreversible. Responses to literacy challenges have often been in legislative form such as the United States “No Child Left Behind Act” (2001) and subsequent Every Child Succeeds Act (2015) which, although offering more financial support for schools, aimed to hold school increasingly accountable for pupil achievement. In the UK, a literacy taskforce was created in 1996 to develop strategies to raise literacy standards in primary schools. This resulted in the 1998 National

Literacy Strategy which aimed to raise achievement in traditional school-based literacy by the introduction of a daily literacy hour. Evaluation by Mroz, Smith & Hardman (2000) found the daily literacy hour to be ineffective based on lack of pupil engagement, a one size fits all didactic approach taken by many schools, a lack of flexibility or enjoyment aspect to the reading strategies used and a dissolution of existing individual reading time in favour of a whole class approach. Follow up analysis by Sainsbury and Schagen (2004), six years after the introduction of the National Literacy Strategy, found that enjoyment of reading had actually declined in the interim 6 years. The National Reading Strategy was subsequently adapted in favour of a more child-centred approach to learning literacy rather than the one size fits all approach that appeared to be ineffective. This led to improved overall reading performance results (Hanke, 2002, Machin &McNally 2004). However, by 2013, the gap between English pupils living in poverty and those not still existed with an estimated 40% of primary school children from poor backgrounds not able to read at the expected level for their age (Department for Education, 2013). A study of primary school children by Save the Children (2017) showed that 85% of children experiencing poverty score who scored below the average level of language ability aged 5, did so again aged 7. Additionally, children who scored above average for language ability aged five then endured economic disadvantage were likely to score below average aged seven. The National Reading Strategy approach was not introduced in N. Ireland. A report by the Northern Ireland Audit Office (2006) noted that the Office of First Minister and Deputy First Minister of Northern Ireland deemed the literacy strategy too regimented for schools in N. Ireland. However, pupils living in poverty perform significantly worse than their non-poverty counterparts at GSCE level and A-level in N. Ireland.

The resources and methods schools employ to help pupil achieve the literacy standards outlined in the Northern Ireland Curriculum for Primary Schools is decided by each

individual school. Central to the approach of schools is aiming to help pupils enjoy reading, rather than seeing it as a chore. Motivation, reading for pleasure and confidence play an important role in improving literacy (Baker, Dreher & Guthrie, 2000; Cox & Guthrie 2001). However, research by Neuman and Celano, (2001) showed that pupils from poorer backgrounds do not enjoy reading as much as their better off peers. Developing a private confidence is often a precursor to public confidence in reading. Children in poverty often don't have the opportunity build literacy confidence and would benefit from the opportunity to do so at homework clubs if home is not a suitable environment in terms of availability of books, overcrowding, hunger and adults to read with (Kellett & Dar, 2007).

1.5 Impact of school budget cuts

The impact of austerity measures on education funding in N. Ireland since 2009, combined with the absence of a Minister for Education following the collapse of the Stormont assembly in 2017, created a difficult teaching environment in N. Ireland. Between 2009-2019, spending on education per pupil was cut more in N. Ireland (11%) than the other parts of the UK (England 8%, Wales, 6%, Scotland 2%) despite pupil number increasing in each region (Britton, Farquharson & Sibieta, 2019). This had a devastating impact on primary schools; teacher pay has stagnated while class sizes have grown to an average of 25 in comparison to 21 per class for other developed countries (Northern Ireland Affairs Committee, 2019). The Department of Education's budget for 2019-20 suffered a real time cut and specialist support for the increasing number of pupils with special needs has been limited; almost one in four primary school children has special educational needs. The added educational needs of pupils with special needs resulted in a budgetary overspend of £17.7million in 2018 as these pupils require more focused one to one interaction with teachers and specialist staff (Education Authority, 2018). Although the presence of SEN pupils didn't seem to have an impact on educational attainment in the way the presence of FSME pupils did (Borooah & Knox, 2014),

budgetary pressures mean that training in supporting children with SEN often isn't possible. The required funding to pay for external expertise or the cost of supply teachers to cover classes for teachers training hasn't been available (House of Commons N. Ireland Affairs Committee, 2019). On the other hand, Amanda Spielman, the head of the regulatory body for UK school inspections, Ofsted, claimed in 2018 that, despite the controversy and impact of school funding, many schools were not making the most of the money available to them (National Association for Head Teachers, 2020). Spielman (2020) claimed schools are cutting back on professional development, teaching assistant are being given full teaching loads, monitoring of teacher performance and provision for vulnerable pupils is being scaled back, and the curriculum is being narrowed to the detriment of pupils, especially those from disadvantaged backgrounds. Schools are now teaching exam technique at the expense of subject content because the accountability system has moved towards performance data rather than what is actually being taught. Speilman claimed attainment had not actually been impacted upon by funding stresses; there was no evidence of falling levels of attainment at key stages 2 or 4, but accepted that, although schools seemed to be coping, the strain put on schools to perform was not sustainable. These claims were echoed by the Head of the Education and Training Inspectorate (ETI) (2016), the body responsible for N. Ireland school inspections, who claimed certain schools were more concerned with their position in league tables rather than the best interest of pupils. The ETI also suggested that many pupils, especially those from socially disadvantaged backgrounds, were not getting a good enough education.

However, these claims and those of Speilman and the ETI have been vociferously rebutted by the Association of School and College Leaders (ASCL) who claim that blame for pupil performance lies ultimately with Government. Lack of funding has forced schools to make often impossible choices in allocation of limited resources (ASCL, 2020). The debate of the

findings of inspections and monitoring has been hindered in N. Ireland however because of a long running dispute between teachers' unions and management centred on pay and conditions. Teaching unions claims members have only received only two 1% pay rises since 2010. This resulted in only 39% of schools complying with inspections in 2018 making assessment and improvement of educational standards much more challenging (ETI, 2018).

Department of Education figures show the ratio of primary school teachers to pupils has indeed increased from 20.4 in 2010 to 22.3 in 2019. This has coincided with a general increase in teacher pupil ratio in all schools from 16.8 in 2010 to 18.3 in 2019. This has been impacted by a decrease in overall teacher numbers from 18,996 in 2010 to 18,336 in 2019, a fall of 3.47% (Department of Education, 2019). Larger classes, failure to replace experienced staff, the delegation of mainstream work to classroom assistants and special educational needs teachers and the narrowing of offered curriculum are the legacy of budgetary cuts since 2010. Although N. Ireland schools appear to have limited the impact of decreased resources on pupil attainment, many feel a breaking point was reached in 2019 when this was unlikely to continue; schools that had to repeatedly postpone spending on equipment, technology, teachers and buildings got to the point where existing resources were no longer fit for purpose. The Northern Ireland education budget is around £2 billion per year; in 2019 increased funding of £421 million has been requested for the new Stormont executive of 2020 to fund teacher pay agreements, SEN funding and essential maintenance work in schools that had been postponed due to previous budgetary pressures.

Educational budgets will be impacted by the considerable uncertainty and anxiety on the likely economic impact of the COVID-19 pandemic. Government revenues are predicted to fall dramatically because of the sharp decline in economic activity resulting in unprecedented decreases in GDP. Additionally, increased spending will be required on health and social care at the expense of other areas of government spending such as education. The World Bank,

(2020) predicts overall Government spending will slow; therefore, even if the percentage spent on education remains the same, the overall amount will decrease. Additional pressures will result for the decrease in ability of households to contribute to school funding because of large scale unemployment; household contributions can account for up to 18% of school funding in high income countries such as N. Ireland (World Bank 2020). After ten year of austerity, the impending economic climate paints very difficult picture for schools. Enormous pressure will build on schools to maintain pupil attainment with restricted resources; in effect, more for less.

Evaluation of exiting methods and ensuring the maximum impact on pupil attainment from all teaching activities will be key; this is a key tenet of evidence-based practice (EBP). EBP doesn't appear to be at the forefront of planning and policy making in the way it is in other fields such as medicine. In the government school resource management strategy, 2018 to assist schools with managing their budgets more effectively, advice is given on many aspects of financial management and procurement. However, little attention is paid to methods of reviewing evidence-based practice when purchasing educational resources. Schools are asked to ensure resources are of good quality, however no reference on best practice or methods of evaluating EBP are referred to. Schools must ultimately decide which educational resources to purchase and to manage their use as they see fit. This allows a level of inconsistency in use of educational resources which may impact on pupil achievement, the teachers' attitude to learning resources and their motivation to implement them within the classroom. Considering the amount of money spent on educational resources, especially those that involve ICT, it is surprising that evidence-based practice is still not seen as a central tenet of UK educational policy.

1.6 Use of ICT in schools

ICT is now an intrinsic part of teaching and learning, with spending in UK schools on educational technology reaching £900 million annually in 2019. Spending on ICT in primary schools rose for the first time since in 2019 since 2016 by 3% to £295.8million (British Educational Suppliers Association (BESA), 2019). However, BESA also reported that the proportion of schools who believe they are well equipped with ICT, has dropped to its lowest point since 2012. Changes in the in the digital world have been so rapid over the past 2 decades that ICT should be seen be as important as numeracy and literacy, with spending patterns to match (Selwyn, 2011). Pupils are required to be computer literate to access much of the learning they will encounter in school. For this to occur, teachers must be confident and competent in the use of ICT and school must have suitable ICT equipment. In 1997, the Department of Education N. Ireland (DENI) developed an integrated Educational Technology Strategy:

… the effective use of information and communications technology (ICT) in the classroom can measurably enhance the learning environment and enrich the educational experience of all our young people. Well used, education technology can encourage a more participative and independent approach to learning, thereby laying the foundations for lifelong learning and personal development (p. 6).

This led to access to a support initiative called New Opportunities Fund Training (NOF) which aimed to ensure teachers were confident and competent in using ICT to raise pupil's achievement levels. Research by Galanouli, Murphy & Gardner (2004) into the NOF training provided disappointing results. Feedback indicated participants felt not enough time was given to the training, teachers were expected to work in their own time at their own expense, and equipment provided was of a poor standard. For many this was their first exposure to ICT

training and created a poor introduction to working with ICT. Subsequent research into the effectiveness of ICT training has revealed the following: a low uptake in teacher use of ICT, a lack of confidence resulting from generic industrial training rather than subject specific ICT training (Hadyn and Barton, 2007), the need for higher quality ICT training to support change and impact in the classroom (Davis, Preston & Sahin, 2009), perceptions that ICT increases teacher workload, time limitations restrict the effect use of ICT (Bingimlas, 2009), variable access to appropriate hardware and ongoing technical problems and lack of ICT support reduce motivation to use ICT (Korte & Husing, 2007). To address the need for appropriate ICT technology, the Department of Education N. Ireland (DENI) has invested £632 million since 2000 providing an ICT infrastructure to N. Ireland schools via the Classroom 2000 (C2K) project. C2K is managed by the education authority and is responsible for proving school with all ICT services, including internet, with the intent of providing fast reliable broadband to all schools. Although generally hailed as a success by practitioners, concerns were raised regarding staff training and the multiplicity of innovations thrust on teachers at one time (Henry, 2005; Uhomoibhi, 2006). A 2020 study by Galanouli and Clark into the development of digital education in primary school in Northern Ireland stated that N. Ireland is the only part of the UK without an up to date digital strategy for education, the last such strategy was released in 1997. The report claims a plan is required to ensure teachers enter the profession with the required ICT skills and continuous training is offered to ensure this expertise is maintained. Wi-Fi connectivity and equipment issues persist despite the work of the C2K project and teacher attitudes to ICT are often negative because of lack of training. Money spent on ICT appears to go to hardware products rather than ICT teacher training with 75% of teachers surveyed saying they hadn't been on an ICT course in the previous 3 years. 67% also confirmed they had no prior qualification in ICT. These findings are mirrored across the UK; a 2018 survey by BESA reported that pupils in half of all state school still

have poor access to ICT and computer equipment with poor Wi-Fi provision cited as the main problem by 65% of primary schools surveyed. A follow up report by BESA in 2019 found that teacher unwillingness to engage with ICT was the biggest obstacle to uptake and use of ICT in Primary schools. They cited a lack of training and a perception that technology could replace teachers as the main reasons behind a reluctance to use ICT.

The perceived impact that ICT would have on educational attainment has not yet been identified. Numeracy and literacy are still taught in the way they were in the year 2000 with ICT used in a supportive way as opposed to a core instructional method. Literacy teaching particularly relies on existing non-ICT methods to build the early learning repertoire required.

1.7 How children learn to read, phonics vs whole language

Although proficient readers can read written materials rapidly, accurately and with full comprehension, four key stages are involved in the process (Ehri, 1995). Stage 1 is the pre-alphabetic stage in which, although little reading skill exists, children may associate visual cues or symbols with spoken words or may have memorised certain words following reading experiences with parents or siblings. Stage 2 is the partial alphabet stage wherein children have learned some letter names and sounds and can use this knowledge to read certain words; mistakes are prevalent at this stage. Stage 3 is full alphabetic knowledge stage in which the full connections between letters and their associated sound has been established. Children develop the ability to identify words they have seen before on sight from memory without the need for letter sound association. Stage 4 is the consolidation alphabetic phase in which children can read words by sight. Sight reading is a sign of skilled reading which enables fast efficient access to the pronunciation and meaning of printed words (Cain, 2010). Fluency is an additional skill required for effective reading; the ability to read at an appropriate pace is vital for comprehension of the text to develop. The National Reading Panel (NRP) (2000),

defined fluency as reading text with accuracy, speed and expression. It is seen as the bridge between decoding and comprehension and its development allows a reciprocal relationship between fluency and comprehension to exist. As fluency develops, regular assessment must be used to assess progress and allow appropriate intervention if required (Pikulski & Chard, 2005). A child's vocabulary is another important aspect of successful reading (Skinner, 1957). The child must be able to respond to the printed word as if it is being spoken by another person. Vocabulary, which is broken into either receptive vocabulary (understanding text or spoken word) or expressive (writing or speaking), has been identified by subsequent research as a key predicator of early reading ability (Hemphill & Tivnan, 2008; Suggate, Schaughency, McAnally & Reese, 2018).

The debate as to the most effective approaches to teaching these stages of reading has been fierce and has endured for almost a century. Two schools of thought dominate the narrative as to the most effective method of teaching literacy; phonics-based instruction and whole language teaching. Phonics-based instruction follows letter-sounds (grapheme-phoneme) rules based on the connection between the 44 sounds (phonemes) in spoken English and the 26 letters (graphemes) of the alphabet. Children learn the sound associate with each letter(s) and blend them together to form words. The alternative is whole language teaching. "Whole Language teaching. Some teachers love it. Some teachers hate it. Many don't even know what it is. But it is changing America's schools" (Eldredge & Baird, 1991, p.193). With whole language teaching, rather than teaching children to break word into their composite pieces and decode, teaches children to recognise that words are complete pieces of language and therefore teaches the individual letter patterns of entire words to be memorised. The theory is that pupils will build a repertoire of sight word that is sufficient to learn to read. Reyner (2008) describes the ongoing debate between proponents of phonics based approaches and whole language instruction as The Reading Wars. In the early twentieth century a whole

language approach was used whereby words were repeated on each page of a book to encourage pupils to remember them. Phonics proponents (Flesh, 1955) criticised this approach as it didn't teach children to read words that they hadn't encountered. Whole language advocates claim that phonics are too complex for children and contain too many exceptions which makes them unteachable (Smith, 1994). Proponents of phonics counter this by claiming over 90% of words are phonetically regular (Shanahan, 2001). The largest study into the most effective method of teaching literacy was carried out by the NRP, (2000) who carried out a meta-analysis of the existing research on both methods. The results showed that phonics-based instruction was highly effective under a variety of teaching conditions with a variety of learners across a range of grade and age levels. Teaching phonemic awareness to children significantly improved their reading ability more than instruction that lacks any attention to phonemic awareness such as whole language teaching. However, the findings of this report were subsequently criticised by a member of the panel, Joanne Yatvin. Yatvin claimed that only one member of the panel (herself) had taught beginner reading and that the other panel members were university professors only concerned with evidence of efficacy rather than the readiness of implementation for any lines of instruction analysed. Although Yatvin claimed that the panel were biased towards phonemic awareness from the outset, she did concede the work was not of poor quality (Yatvin, 2000). Additionally, criticism came from the NRP's promotion of the use of phonemic awareness as some sort of magic bullet solution to the literacy failure as it would discourage changes in social policy to address ongoing poverty (Coles, 2001). Despite this criticism, the NRP review supported the effectiveness of phonological training over whole language approach and it was general accepted the reading wars had been settled by the NRP's findings (Pearson, 2004). However, analysis of more recent research highlights the fact that the debate continues unabated with proponents of phonics (Taylor, Davis & Rastle, 2017; Castles, Rastle & Nation, 2018)

maintaining its efficacy while others continue to question the interpretation of the results of many studies including the NRP, 2000 (McArthur et al, 2018; Bowers, 2020).

1.8 Teaching phonics in UK schools

Research into the development of reading skills has shown that pre-literate children initially learn words via the auditory system (Ziegler & Goswami, 2005; Anthony et al, 2002). Pre-school children's phonological skills depends much on the richness and variety of their oral language experiences at home. Ziegler and Goswami found that children's phonological systems are in place and developing before literacy training occurred; Phonological skill such as such as onsets (the initial phonological unit of any word), rimes (the string of letters that follow) and syllables (part of a word that contains a single vowel sounds pronounced as a unit) were present in children before phoneme awareness was taught. In a study of one thousand pre-school children, Anthony et al. (2002) produced a hierarchy which suggested children mastered word level skills before syllable level skills, syllable level skills before onset/rime level skills and mastered onset/rhyme level skills before phoneme level skills. Teaching phonics involves saying each letter sound distinctly from left to right, distinctly joining them together smoothly without pausing between each sound (Johnston & Watson, 2004, p347). In 2010, the UK Government implemented a policy that required schools to use phonics to teach children literacy. Until then, a combination of phonics and whole language approaches were used. The UK Government claimed that using phonics has improved literacy in UK schools; the 2016 Progress in International Reading Literacy Study (PIRLS, 2017) tested the first cohort of children to be taught phonics in 2016 as part of an international study. UK pupils came 8th/56 as opposed to 15th/56 in 2006. Additionally, in the first year of a new phonics check for six-year olds in UK schools which tests correct pronunciation of 40 words and sounds, only 58% of six-year olds reached the pass mark in 2012. By 2016 this had increased to 81% (Department of Education, 2016). While the overall

picture of literacy is improving, the gap between those living in poverty and those not still exists. The percentage of FSME children reaching the expected standard in reading and writing aged 11 in 2018 was 46% as opposed to 68% for non FSME (Department of Education, 2016).

The Department for Education, (2014) outlined an Early Years Foundation Stage Framework which set out the early learning goal for reading:

> "Children read and understand simple sentences. They use phonic knowledge to decode regular works and read them aloud accurately. They also have read some common irregular words. They demonstrate understanding when talking with others about what they read."
>
> (p11)

Jolliffe, Waugh and Gill (2019) suggest effective teaching of phonics involves use of a range of phonics resources including magnetic letters and boards, images, charts, books, reading areas, ICT, puppets, role plays, songs and games to provide a stimulus rich phonics learning environment. Key aspects should include providing the ability to apply the understanding through practice reading while ensuring reading is enjoyed. Often, teachers will use a combination of these resources to teach pupils one letter-sound combination at a time building the required repertoire over the school year. The Rose Review (Rose, 2006) of teaching early reading concluded that high quality phonic teaching featured multi-sensory activities including visual, auditory and kinaesthetic activities involving physical movement to mimic letter shapes and sounds and the manipulation of magnetic or other solid letter shapes to build words. Additionally, the review found successful teaching of phonics included use of mnemonics such as pictures of animals which began with certain letters such as C=Cat. Ofsted (2010) concurred in a review of 12 primary schools rated as excellent in the

teaching of English finding the schools all adopted multisensory methods and a "rigorous, systematic and intensive approach" (p3).

In N. Ireland, schools are not under the same obligation to teach phonics in the way their counterparts in England are. The fact that pupils from N. Ireland performed better than their English counterparts in the 2016 PIRLS test led some to question how this was possible; if in fact strict adherence to phonics teaching produced better results, how could children not being taught by systematic phonics perform better than those who were? (Bowers, 2020). However, N. Ireland primary school do incorporate systematic phonics instruction into their literacy teaching. The difference is that N. Ireland schools can incorporate other methods as well as systematic phonics if they so wish. This decision lies with each individual school. Currently there is little research into identifying and categorising the actual methods used by schools (This is discussed in greater detail in Chapter 5). It is important to note however that guidance sent out to schools from the Education Library Boards is based on use of the linguistic (synthetic) phonics approach.

1.9 Strategies for improving literacy.

Apparent improvements in literacy masked the fact that an attainment gap exists between disadvantaged children and their non-disadvantaged peers. In response to an ETI Report NI, 2008 which stated "there remains too significant a variation in the standards of literacy and numeracy attained by children across primary school" (p33), the Department of Education N. Ireland developed the Every School a Good School (2009) policy. This aimed to improve standards in schools across N. Ireland by use of key principals: a pupil centred approach, equity of access, effective leadership, community support, the provision of high-quality teaching, sustained improvement, use of external support and review, use of effective interventions, accountability and collaboration and removal of barriers to learning

(Department of Education, 2009). This in turn led to the development of the Count Read Strategy (CRS), (2011) to specifically target numeracy and literacy underachievement for those from poorer socio-economic backgrounds. CRS contains detailed action plans for teachers and pupils in which the importance of effective teachers with access to evidence-based approaches are highlighted:

"This strategy recognises that teachers are the key to raising standards by meeting the needs and aspirations of pupils through high-quality teaching and learning…the quality of an education system cannot exceed the quality of its teachers…Guidance for teachers on a broad and balanced range of best-practice, evidence-based approaches to teaching literacy and numeracy will be produced, disseminated and kept updated" (p3)

Additionally, best practice literacy teaching methods from other schools were highlighted a key tenet of performance improvement:

"A key element of the school improvement policy is to identify more consistently the excellent practice that exists in our system, then to disseminate and embed it to raise standards in all schools" (p15)

CRS recommended that teachers receive high quality support to help them raise standards of literacy and numeracy, have access to examples of best practice in raising literacy and numeracy standards and have access to curricular resources that have literacy and numeracy at their core. Furthermore, teachers should get the right help at the right time to tackle underachievement and that the resources used in these situations are used as effectively as possible to support raising standards in literacy and numeracy. Monitoring of literacy should be ongoing, and underachievement, when by teacher via tests, reading exercises or other behaviour should be addresses as soon as it emerges as follows. Interventions should be applied immediately upon identification of literacy difficulties. Each teacher will decide the

appropriate form of support that each pupil requires. These will be one to one and/or group interventions which should be time bound and target based. Support will be from existing school resources. The CRS suggests that if unsuccessful, the intervention can be repeated or changed. If underperformance still exists despite repeated intervention by the class teacher, other support from within the school will be sought. This may be a literacy coordinator, head of department, school senior management team, mentors or other support staff. An action plan should be created. No external support other than advice can be sought at this stage. If the pupil is still underperforming following this intervention, external support may be sought from the local Education and Library Board (ELB) Education Skills Authority (ESA) or health professionals as appropriate based on provision of the comprehensive record of support offer to that point and evidence of underachievement. This support will focus on supporting the teacher to meet the pupil's needs and once again, will be time bound and target based. Pupils still underachieving at this stage will be assessed for special educational needs. In this case school must follow the Code of Practice on the Identification and Assessment of Special Educational Needs and act accordingly.

Although the process of definition of problem-assessment-intervention-review is sensible, the lack of focus on evidence-based is concerning. At each point of intervention, teachers, classroom assistant, literacy coordinators, management and external agencies are instructed to carry out specific literacy interventions with an underperforming pupil. What these interventions are and on what grounds they are used is not discussed. Furthermore, the CRS actually directs teachers to repeat strategies which have been unsuccessful as part of the initial intervention; hardly a ringing endorsement of best practice. Rather than discuss the value and potential use of evidence-based practice that has been proven to work in similar situations, the CRS promotes only the sharing of best practice between schools. However, what works in one school with a certain pupil may not in another school. This not evidence-

based practice which has been rigorously, independently tested and replicated. Nor does this fit with the aims of the CRS of rigour, evaluation and effective intervention whereby ineffective processes are changed based on, in the simplest terms, whether they worked. The CRS guidelines represent the framework of intervention used by N. Ireland primary schools for pupils struggling with literacy. The lack of success in addressing the needs of these pupils indicated by repeated attainment results, reflect the lack of depth and application of best practice contained within these guidelines. If the guidelines are not fit for purpose, the subsequent interventions used in schools are also likely to fail. Unfortunately, the N. Ireland literacy attainment results for disadvantaged children in comparison to their non-disadvantaged peers demonstrate this is indeed the case.

When selecting literacy resources to support underachieving children, educators are faced with a plethora of interventions, guides and online programs. Brooks (2016) evaluated 32 such reading programs and interventions used in the UK and found a wide variety of gains, effects sizes and claims of efficacy. A key criterion for inclusion was that programs were aimed at children who were already struggling with literacy as opposed to general literacy teaching programs. Many programs contain evidence of efficacy that, to the layman would be very convincing. Programs such as Arrow (Aural Read Respond Oral Write), Academy of Reading, Acceleread, Lexia and Project X Code claim to have improved the literacy performance of users. However, upon review by Brooks, it was apparent that in all cases no control groups were used for comparison purposes and no statistical significance data were published. A further review by Rack (2011) of the Units of Sound reading program found although there were statistically significant gains in standardised reading scores, again no control group was used so comparison data were not available. All discussed literacy programs rely heavily on anecdotal evidence and case study as evidence of efficacy. Additionally, few mention the recommendations of the NRP (2000) of the five essential

criteria for effective reading instruction or indeed a framework for effective learning such as reduced errors, master criterion, guided practice and cumulative review. Equally, the Education Endowment Foundation UK (2018) assessed 38 literacy programs and found 42% had either no effect or negative effect on literacy. Only 26% were considered promising. This highlights a dilemma faced by principals, teacher and literacy coordinators; how to select the most effective resources to help improve pupil literacy. Budgetary cuts, increasing class sizes and additional number of SEN pupils make the choice increasingly difficult. Evidence on the efficacy has varied wildly. Brooks et al. (1999) warned that the scientific evidence of literacy programs varied from the meticulous to the appalling. In the two decades since, this is still apparently the case. The evidence of efficacy of many literacy programs is framed in a very convincing manner which requires a level of insight and training to independently evaluate. Unfortunately, this is not an area addressed in training for new teachers or indeed in professional development of existing teachers. Furthermore, EBP is not an area in which government has offered authoritative guidance or leadership through policy or funding. This leads to the inevitable question, how are educators meant to know what works?

1.10 Evidence-based practice in education

In Crimean war of the 1850s, Florence Nightingale noted a connection between poor sanitary conditions in hospitals and death rates among injured soldiers. Her subsequent effort to sanitise the hospitals resulted in a dramatic drop in death rates (Baker, 1983). This is an early example of evidence-based practice (EBP). Sackett (1996) defines EBP in medicine as "conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients (p3). The term "evidence-based" was brought to prominence in the Journal of the American Medical Association in an article by the Evidence-Based Medicine Working Group in 1992 on the role of evidence-based practice in medical education (Rahman & Applebaum, 2010). The introduction and use of EBP in medicine

wasn't straightforward. Goldacre (2013) explains how up until a few decades ago medical practice was driven by the eminence of the doctor, charisma and personal experience. Many doctors fought against evidence-based medicine as a challenge to their personal knowledge and authority. Since the introduction of EBP, medicine has improved dramatically, as now "what works" is easier to test. Outcomes for patients are better, based on thousands of tiny steps forward that EBP and testing has allowed. Although EBP originated in the field of medicine initially to teach students, then as a model in clinical decision making and practice, it has spread to many medical fields such as dentistry, nursing, occupational therapy and beyond into human resources management, social work, probation services and education (Biesta, 2007). A broader definition of EBP is "the use of the best available evidence to bring about desirable outcomes, or conversely, to prevent undesirable outcomes (Kvernbekk, 2016).

Hargreaves (1996), one of the proponents of EBP in education, suggested that medicine has an academic infrastructure founded in the natural sciences such as anatomy, and physiology; education has no such knowledge base and therefore lack a common technical language. Hargreaves suggest whereas the field of medicine has gained public prestige because of the growth of its research, the teaching profession has not. In 1998, Congress in the USA appropriated $150 million per year to provide schools to adopt "proven" (in terms of experimental control comparisons on standards-based measures), comprehensive reform models. By 2001 this had been increased to $310 million per year. The "no child left behind" Act of 2001 mentions scientifically based research 110 times and defines scientifically based as "rigorous, systematic and objective procedures to obtain valid knowledge". Problems have arisen with this extra funding with suggestions that the programmes have been put together to access this funding and that reviews of effectiveness have shown that only 1 in 5 grants have gone to programs rated as having strong evidence of their effectiveness (Slavin, 2002).

Clearly, the failure to ground education in science, has left educators susceptible to the authority syndrome, as well as "fad and gimmicks that ignore evidence-based practice" (Stanovic, 2003, p5). To examine the effectiveness of educational methods and resources, national governments have set up bodies to apply scientific rigour to the testing the efficacy of many educational methods and resources including literacy programmes. The US Government Department of Education's Institute of Education Sciences developed the What Works Clearinghouse (WWC) in 2002 to provide educators, policy makers and the general public with scientific evidence with what work in education. The WWC tested the efficacy of 229 literacy intervention available internationally and found that only 24% (56/229) showed positive or potentially positive results. 11% showed mixed or no discernible effect while 65% (149/229) had no evidence of efficacy whatsoever (WWC, 2020). Similarly, the UK government developed the What Works Network (WWN) in 2014 to improve the design and delivery of public services including education. The WWN analysed studies of 3 phonics-based literacy approaches, Butterfly Phonics (£108 per pupil), Freshstart (£116 per pupil) and Rapid Phonics (£205 per pupil) and found small sample sizes and limited study periods resulted in questionable outcomes. For one programme, Rapid Phonics, no literacy gains were found among participants (Department of Education, 2018). Clearly, ineffective approaches are costly to both the schools purchasing them and the pupils they are used with.

For many schools, already struggling to operate within their budgets while coping with increasing class sizes, purchasing educational resources with limited efficacy makes little sense. Additionally, use of ineffective resources may result in other, more effective approaches, being denied to pupils who most require them. The question of how schools purchase resources is therefore a pertinent one. Approval of school purchases is normally the remit of the Principal. They may or may not be involved in the process of reviewing resources depending on many factors such as school size, available budgets and the

competency and confidence in the performance of the literacy coordinator. The role of literacy coordinators differs according to the size of the school, existing job descriptions and roles of other staff. The N. Ireland assembly completed a briefing note in 2012 comparing the role and requirements of literacy coordinators between N. Ireland and the rest of the UK. This briefing identifies their role as planning and supporting the effective use of pupil data, supporting teachers with underachieving pupils, improving practice within school and encouraging reading within school. Training comes from the local Education Authority which includes supporting teaching materials for use in schools. For such an important role, the qualifications required are surprisingly straightforward, beyond the required teacher qualifications, they must have achieved a grade C or above at GSCE in English. This is the same throughout the UK. Additionally, no mention is made of knowledge of evidence-based practice, despite the fact a literacy coordinator is influential in the procurement and application of what can often be expensive and ineffective learning literacy resources. The funding of such resources in N. Ireland comes from the school budget including additional payments from the common funding scheme, designed to address inequality by providing extra funds for pupils from a disadvantaged background. The guidelines on what this money should be spent state that the formula (for calculating the common funding scheme amount per school) should support schools in delivering the curriculum by enabling Principals to plan and use resources to maximum effect in accordance with their own needs and priorities (Department of Education, 2019). Schools are required to account for how they spent their common funding scheme funding via their planning process documentation. Expenditure must be from within the approved budget unless otherwise agreed by the funding authority. However, as yet, no proof of evidence-based practice is required when purchasing educational resources. An evaluation of this area was commissioned by the Department of Education, (2017) to "assess progress towards a system within which the teaching profession

improves practice through the rigorous use of robust evidence" The report found the following key findings:

> "the language of evidence is confused, while schoolteachers may consider magazine articles about teaching as evidence of effectiveness, universities for example require a tighter definition involving systematic research." (p10).

Although most teachers valued research evidence, most interviewed were not confident in engaging with research or feel able to judge its quality. Additionally, the majority of teachers were not convinced by research evidence on its own; they often sought evidence from trusted colleagues in other schools to support it. The report found that schools who engaged the most with research, had strong leadership teams that fully incorporated research evidence into their schools, prioritised its implementation and were often involved in external research projects. National policy needs to be strongly aligned with research evidence; often specialist organisations such as the Education Endowment Foundation had more of a focus on evidence-based education than government bodies. More recent research such as the National Foundation for Educational Research (NFER), (2019) confirm that evidence-based practice continues to have a limited impact in informing teacher's decision making. Teachers are still likely to draw on their own experiences or that of trusted peers, or that obtained from Continuing Professional Development (CPD) Programmes. Interestingly, only one fifth of respondents said CPD influences on their decision making were based on what they understood was evidence-based research. Additionally, the research found although schools would often provide a positive climate for evidence-based practice, no formal processes were in place to do so. The report concluded that evidence-based practice occurs best when there is a convergence of 3 forms of evidence: research evidence, classroom data and professional judgement.

The process of purchasing educational resources differs from school to school. The factors which most influence purchases are cost, recommendations from other teachers and the opinion of the decision maker in each school. This results in an inconsistent approach to the use of purchased educational resources. Schools will often use finite resources to purchase resources that in effect have little or no impact on the performance of pupils. Whereas systematic phonics instruction leads to improved and maintained reading ability (NRP, 2000; Snow, Burns & Griffin, 1998, Hatcher, Hulme & Snowling, 2004), other methods rely on quick fixes which aren't generalised or maintained (Tobin & Calhoon, 2009).

Clearly, this is an area where further research is required and better, evidence-based mechanisms are put in place to support schools in their purchase of external teaching resources.

1.11 Computer Assisted Instruction in education

We live in a digital age in which technology has had a dramatic impact on society. Technology is now an intrinsic part of communication, shopping, entertainment, education, employment, medical services and day to day life in a way that was unimaginable at the start of this millennium. Children born into this virtual world, "digital natives", are outpacing their parents and teachers "digital migrants" (Macbeath & Alexandrou, 2015). Computer Assisted Instruction (CAI), an aspect of ICT which involved drill and practice, tutorial and simulation plays an increasing role in education based on the premise that computers are used to assist both the learner and teacher in the educational process. CAI presents learning material and monitors/tests the learning that takes place. CAI provides information, stimulation and testing from words, sounds, pictures, videos, games, animations, puzzles and imagery which can improve use the learning function of different sensory organs (Wong & Li, 2008). Technology in education can be traced back as far as 1866 when Halcyon Skinner patented a

mechanical device used to help people spell words. Stanley Pressey developed this idea further in 1915 by adding a reward element to a teaching machine that scored tests in which a piece of candy was awarded for reaching criterion level (Norman, 2017). In 1958, BF Skinner, a pioneer of using the science of applied behaviour analysis to improve learning, build on Pressey's work by advocating the use of "teaching machines" to use a method of teaching called programmed instruction (PI). PI was a series of small steps arranged in a coherent order and called frames which student worked on via prompts and instruction from a machine. Skinner suggested that use of these machines created conditions for vastly improved study, increased concentration, provided immediate feedback, allowed each student to move at a pace that was most effective for them, ensured mastery was achieved and allowed twice as much material to be covered as traditional teaching methods in the same period. Skinner referred to each CAI trial as a frame (as it was viewed in a framed window) which included the onscreen target antecedent, prompts, followed by the requirement for a response from the learner. Correct responding led to the next frame. This process itself acted as a reinforcer; erroneous answers were not reinforced, and progress was not permitted until the correct answer was provided (Schunk, 2012). Skinner's idea was subsequently developed into a method called Personalised System of Instruction in which learning is paced according the individual and a learner masters one piece of learning before moving onto the next (this was outlined as "Mastery Criterion" one of the five key tenets of effective reading by the NRP, 2000). In the 1960s, Stanford University used CAI by having children participate in daily maths drill and practice on a teletype machine that was connect to Stanford University via phone lines. The CAI students made greater gains in arithmetic achievement as measured by the Metropolitan Achievement Tests than students who were taught using traditional teaching methods (Weiner, 1970). Although rudimentary by today's standards, early studies of CAI suggested it helped improve classroom behaviour (Feldmen & Sears, 1970), improved

scores in standardised achievement tests (Vinsonhaler & Bass, 1972), supported teachers to be more productive in their methods (Jamison, Suppes & Wells, 1974) and allowed more work to be completed in less time (Singh & Morgan, 1971). The cost of CAI however was prohibitive in the 1970s; the study by Singh and Morgan found that CAI cost $2.60 per student hour compared to $0.60 for traditional teaching methods. This changed in the 1970's with the advent of the personal computer. The large mainframe computers evolved into smaller personal computers in the late 1970's as companies such as Apple, IBM, Atari and Commodore unveiled machines capable of sharing information, carrying out large and complex calculations, storing data and playing games (although basic compared to today's standards). Computers were now no longer seen as a luxury; they were now a necessity for schools and have been integrated into education ever since.

In teaching terms, the use of CAI has evolved from the original drill and practice to variations including tutorial, problem solving, simulation, computer programming, games and discovery programs which are now frequently used in educational institutions and in virtual online environments. Computers can overcome limitations of the written word by use of graphics, sounds and multimedia (Molnar, 1997). Although they can be difficult to use, virtual and augmented reality educational programs offer a new and exciting learning experience for learners (Akcayir & Akcayir, 2017). CAI learning is available for every subject taught in the UK curriculum. In terms of literacy there are a plethora of options availed to purchase as previously discussed. The general findings of research into CAI literacy programs is that they should be used to supplement the teacher, not replace them (Balajthy, 1995). Meta-analysis of the efficacy of CAI literacy programs at the start of the millennium when CAI was coming to the fore found small but positive effect sizes (Blok, Oostdam, Otter & Overmaat, 2002, NRP, 2000). These results have been supported by further studies (Macaruso, Hook & McCabe, 2006; Macaruso & Walker 2008) which have shown better literacy performance from pupils

receiving CAI literacy instruction than those not. Literacy is a subject which research has shown benefits from the use of CAI more than other subjects. The drill and practice aspect of learning to read using a phonic approach can be stimulated in many ways by use of CAI to encourage longer period of practice than text alone would allow. CAI is however only one form of ICT; although there is evidence for the effectiveness of CAI, especially for literacy, the evidence for other forms of ICT is not so clear. Although the introduction of ICT has been transformative in facilitating student centred teaching environments (Hannafin & Land 1997) research on its efficacy remains unclear. In general, despite thousands of impact studies, the impact of ICT in general on student achievement across all subjects is unproven and open to debate. For every study that cites positive impact another study finds little or no impact (Trucano, 2005). Studies (Macaruso & Walker 2008; Pilli & Aksu 2013) and meta-analysis (Richardson, 1997; Kulik, Kulik and Cohen, 1980; Kulik, Kulic and Bangert-Drowns, 1985; Kulik & Kulik, 1991; Bayraktar, 2001; Camnalbur and Erdogan, 2008) found that ICT made significant contributions to the academic achievement of students and an increase in positive attitude to the use of CAI in education. Conversely, a large study by the US Department of Education (2002) on the effect of such educational software on standardised test scores showed that test scores were not significantly higher in classrooms using CAI than those that were not. Other studies supported these findings (Vichitvejpaisal et al, 2001). Livingstone, (2012) reflecting on the benefits ICT in education suggested that although recent years has seen a steady embedding of digital technology in classrooms such as interactive whiteboards, laptops, educational programmes and use of e-mail and e-learning programmes, evidence of improved learning outcomes remains “surprisingly elusive”. Harrison et al. (2002) evaluated the UK governments ICT in schools programme and reported that “in some subjects the effects were not significant and were not spread evenly across all subjects” (p1). Similarly, Dynarski et al. (2007) in a report to US Congress found that students using reading and maths

software for up to a year showed little difference to those exposed to traditional teaching methods. The Education Trust (2010) suggested that although the claims for how technology can improve educational performance are widespread and influential, the evidence is extremely weak and the motives of those making these claims is often clouded.

The Education Endowment Foundation's (EEF, 2017) "Using digital technology to improve learning" report suggests that although technology is unlikely to improve pupils attainment, the pedagogy behind it can; buying an iPad won't help, using an iPad to increase quality and quantity of practice pupils undertake will. The EEF suggest 4 key recommendations for using digital technology; consider how technology will improve teaching and learning before introducing it; technology can be used to improve the quality of explanations and modelling; technology offers ways to improve the impact of pupil practice; technology can play a role in improving assessment and feedback. Assessment and feedback are key aspects of CAI and may explain its relative success in improving pupil attainment in comparison to other general types of ICT.

Children born since the year 2000 have a different opinion of ICT than those born before 2000. A novelty effect amongst pupils of ICT in the 1990s was seen in studies (Krendl & Broihier, 1991; Stradling, Sims & Jamison, 1994) in which improved attitude and previously unseen perseverance in learning tasks, when using ICT, was seen. More recent research (Aesaert & Van Braak, 2014) showed pupils rated themselves very highly at searching the internet and using ICT and are less likely to benefit from the novelty effect. The people purchasing educational technology however are still those born before the year 2000, the digital migrants. The Financial Times (2015) reports that by 2020 the global market for educational technology will grow to £129 billion. The question of the impact of this technology has increased in tandem with the plethora of educational technology available. The Organisation for Economic Co-operation and Development (OECD), (2015) developed a

comparative analysis report to evaluate the digital skills that students have acquired and the impact it had on student performance. This report uses the results of the Programme for International Student Assessment (PISA) which measures the reading, mathematics and science literacy ability of 15-year-old students from different part of the world every three years to evaluate the impact ICT has had on each of these areas. The report found that although 96% of 15-year-old students in OECD countries reported having a computer at home and 72% reported using a computer at school, between 2000 and 2012, the reading performance of students with higher levels of access to the internet declined. The report suggests that the real contribution to teaching and learning of ICT has yet to be realised and exploited. Ensuring that children reach a baseline of Maths and English requires more than simply expanding access to technology. While the PISA results suggest that limited use of computers may be better than no use, it also suggest that too much use is associated with significantly poorer student performance. When ICT such as CAI improves study time, incorporates drill and practice, provides effective measurement of performance and reacts accordingly via immediate feedback and correction, student performance improves. These are key tenets of the application of Applied Behaviour Analysis (ABA) in teaching. When these are not incorporated into teaching via ICT, research has shown effects to be at best, questionable.

1.12 Applied Behaviour Analysis and teaching literacy

As well as the increasing popularity of behaviour analytic academic interventions, research (Swanson & Hoskyn, 1998; Vaughn, Gerstein, & Chard, 2000) has repeatedly shown that educational behaviours that are based on Applied Behaviour Analysis (ABA) are the most effective in teaching literacy. Proponents of ABA have urged the use of behavioural and functional assessments for academic difficulties and challenging behaviour (Alessi, 1980; Lentz and Shapiro, 1986), use of behavioural framework for reading interventions (Lentz,

1988), precise measurement of learning rates (Skinner, 2008), use of learning trials to improve academic responding (Skinner, Fletcher, & Hennington, 1996) and effective use of differential reinforcement in providing ongoing feedback (Catania, 2007).

Ultimately, the goal of instruction is for students to respond to educational demands without assistance or prompting; students learn an academic task when their responding comes under the control of academic stimuli (Vargas, 1984). A non-proficient reader displays low rates of responding when letters and words fail to function as discriminative stimuli (Daly, Martens, Dool & Eckhart, 1999). Using the principles of ABA in teaching involves applying methods of instruction in a conceptually systematic way to help students acquire, maintain and generalise skills (Cooper, Heron & Heward, 2007). Key components of the principles of ABA in teaching are: immediate performance feedback: proving specific information on how a person performed on a particular task including types of errors (Begeny, Daly & Valleley, 2006), systematic review: a cumulative review over time in a distributive manner (Coyne, Kame'enui & Simmons, 2001), generalisation: demonstration of skills during untrained conditions (Skinner & Daly, 2010), modelling: demonstration of how to perform specific skills (Cohen, Heller, Alberto & Fredrick, 2008), prompting: providing a signal for a pupils to emit a response (Rouse, Alber-Morgan, Cullen & Sawyer, 2014), fading: the systematic removing of prompts (Mayfield, Glenn & Vollmer, 2008), frequent response opportunities: allow numerous and continuous opportunities for leaner response have been shown to improve pupil literacy performance (Everhart, Alber-Morgan & Park 2011).

Skinner (1957) identified literacy as textual behaviour and transcription; Textual behaviour is matching spoken responses (pronunciation) to written stimuli (a printed word), transcription is matching written responses (writing) to spoken stimuli (dictation) (p65-66). The verbal stimulus which controls such responding may include praise from a teacher or peers for correct pronunciation. ABA has contributed to many educational practices and technologies

used to assess educational literacy practices, measure literacy performance, observe the instructional environment and evaluate evidence-based literacy procedures (Dunlap, Kern & Worcester, 2001). Many literacy programs are developed based on the learning and experiences of their designers without evidence of a supporting scientific framework. Although users may enjoy using these programs because modern multimedia makes them fun and engaging, the question of efficacy remains. Behaviour analytic procedures on the other hand employ methods of instruction such as the stimulus-response-consequence three term contingency in a conceptually systematic and explicit way (Joseph, Alber-Morgan & Neef, 2016). In addition to the educational framework that ABA provides for learners, research has suggested that applying ABA principles such as immediate performance feedback can improve the performance of literacy teachers; Cuticelli, Collier-Meek and Coyne (2016) increased the frequency of pupil opportunity to respond during literacy teaching by providing immediate graphical and oral feedback to teachers-opportunity to respond is known to be an important feature of instructional quality (Daly, Hintze & Hamler, 2000; Kern & Clemons, 2007; Hattie & Timperley, 2007). One online literacy program that has harnessed these principles is the Headsprout Early Reading program.

1.13 Headsprout Early Reading literacy program

Headsprout Early reading (HER) is an online, interactive reading programme that aims to improve the acquisition of reading skills in pre-primary and primary school children. At the time of this research, HER cost $199/£151.60 to purchase for which 36 individual licenses are provided for one year. Each license provides access to 80 HER lesson plus the 50 HER comprehension episodes at a cost of $5.52/£4.21 per pupil. It was developed by Layng, Twyman and Stikeleather (2003) with the intention of developing a reading program based on the principles of Applied Behaviour Analysis. Headsprout encompasses both the Headsprout Early Reading (HER) and Headsprout Reading Comprehension (HRC)

programmes which use an individualised approach that adapts to the needs and performance of each user. Students' progress through 80 episodes set in 4 online environments: Space world, Dinosaur world, Jungle World and Undersea world, and are taught then tested on key areas such as phonemic awareness, phonics, fluency and vocabulary throughout. Layng, Twyman, and Stikeleather (2003) outline how Headsprout tackles the five key interconnected reading sub skills necessary identified by the National Reading Panel (NRP), 2000 for reading proficiency:

Phonemic awareness: Learners hear sounds then select from visual stimuli, are asked to say the sounds, put sounds together, say them blended then say them fast as intended. They learn to say letters and words individually and as blended units.

Phonics: HER teaches 84 carefully chosen phonetic elements which are consistently pronounced in 85% of words. Exceptions and more complex rules regarding sounds and/letter associations are taught later in the programme when confidence and mastery has been established.

Vocabulary development: HER teaches students that letters make up words which have meaning and, when put together, form sentences that also have meanings. The intention is that within 30 hours of instruction, students can build a vocabulary of over 5000 words.

Reading fluency: HER incorporates carefully designed fluency activities from the start of the programme. Over 50 fluency designed activities are incorporated into the 80 episodes; additionally, the student will practice 70 separate stories to build a strong reading repertoire.

Reading comprehension: HER incorporates increasingly challenging comprehension indicators to test if the student understands what they have been able to decode by use of pictures, sentence building and text reading.

Twyman, Layng and Layng (2011) identify the nine teaching routines incorporated into HER as establishing routines, adductions routines, vocal potentiating routines, blending and segmenting routines, sentence and story routines, fluency routines, motivations routines, application routines and overall sequencing. HER was developed to meet educational standards in the USA for children from preschools to year 5 (K-5). It links to the Common Core State Standards (CCSS) which mandates what each child should know in English Language, Arts and Mathematics at the end of each school year. HER's research-based reading methods aims to improve children's reading ability to levels at or above those expected for their age group. HER was developed with rigour and enormous resources were used in its development. "Headsprout scientists and instructional designers employed scientifically derived instructional principles drawn from both the basic and applied learning sciences, and a rigorous, control–analysis formative evaluation process throughout the development of the product" (Layng, Twyman, & Stikeleather, 2003, p5). Precise objectives and specific instructional strategies were identified and tested in the developer's laboratory. The target was for 90% of learners to meet 90% of the outcomes; if this didn't occur, revisions were made. Upon completion of initial revisions, a further testing stage began whereby one thousand users tested HER with the goal of ensuring 90% of learners met 90% of the outcomes. More revisions were made following these tests. Subsequent tests were performed in schools which supported the results that had been achieved in the previous tests. Throughout development, millions of data points were extracted which led to over 10,000 programme revisions. Grindle, Hughes, Saville, Huxley and Hastings (2013) outline how HER incorporates four key learning frameworks consistent with a Applied Behaviour Analysis (ABA) teaching methodology: reduced errors: teaching begins at a simple levels and gets increasingly challenging helping to reduce errors, mastery criterion: progress depends on meeting certain goals, guided practice: time criteria is introduced to develop accuracy and

speed and cumulative review: previously taught skills are revisited repeatedly throughout the programme. HER adapts based on the frequency and ratio of correct/incorrect responses by offering increase practice opportunities and vocal reinforcement. Complex tasks are broken down into the smallest teachable components with student progress rewarded throughout. The result is a program that the developers claim offers a balanced approach to teaching literacy that combines the best approaches gained from the scientific study of reading and the experimental analysis of behaviour, instructional system design, practical application, applied behaviour analysis and classroom teaching.

HER efficacy.

Twyman, Layng and Layng (2011) showed instructionally beneficial results on standardised tests for kindergarten and first grade children who had completed at least 41 out of 80 lessons of HER compared to control groups. The effectiveness of HER has been researched in studies on various cohorts. Grindle et al. (2013) and Whitcomb, Bass, and Luiselli, (2011) used Headsprout to study its effectiveness on children with ASD and showed improvements on word recognition reading age of between 14 months and 2 years, improved reading accuracy, generalisation of word set reading skills and maintenance of improvement in the months following the intervention. Huffstetter et al. (2010), and Pindiprolu and Forbush (2009) examined the effect of using HER with children considered at risk from living in poverty and found those children made gains in early reading, oral language skills and phoneme segmentation fluency following use of HER. Storey, McDowell and Leslie, (2017) investigated whether using HER to supplement existing teaching improved the literacy of children who have spent time in care. Results showed improvements in word recognition age and reading fluency in comparison to a control group who had received online Maths tasks over the same 4-month period. Clarfield and Stoner (2005) studied the effect of using Headsprout on oral reading fluency and task engagement with three students identified with

ADHD. The results suggested that the program was effective in improving both outcomes compared to teacher directed instruction. Cullen et al, (2014) investigated HER's effect on reading comprehension with students diagnosed with intellectual disabilities and /or emotional disturbance/other health impairment. The results showed substantial increases in reading comprehension for all six participants. Watkins et al. (2016) evaluated HER in two mainstream schools in north Wales. The research was twofold: whether use of HER improved early reading and did implementation support i.e. teacher training, improve attainment for pupils. Analysis of pre-test and post-test standardised reading scores indicated significant improvement in reading scores for pupils who used HER and an improvement in pupils correct word sub test measure in the schools that received the implementation support. This followed a 2015 study in Wales from Tyler, Hughes, Beverly and Hastings (2015) in which 51 children from mainstream schools were placed into either a HER or a control group. The HER group received instruction for 45 mins a day for eight months and showed significant literacy improvements over the children who didn't use HER in reading accuracy and word recognition skill. The increasing evidence base for HER as an effective literacy program contrasts with many other such programs. Whereas HER uses the rigor of science and best practice, other programs often rely on testimonies and anecdotal evidence as evidence of efficacy.

The evidence base for the efficacy of HER is clear and increasing. This thesis aims to add to the existing body of evidence which supports the phonics-based approach to literacy used in the HER program to improve the literacy performance of users. It will assess the impact HER has on the literacy performance of disadvantaged pupils in N. Ireland who are already struggling with literacy in direct comparison to similar pupils receiving teaching as usual. It will also evaluate the viability of schools using HER with existing staff and the challenges of

implementing such programmes in addition to the existing demands of teaching the curriculum.

Chapter 2: Evaluation of a school based Headsprout intervention on improving literacy

2.1 Introduction

"Literacy is a bridge from misery to hope. It is a tool for daily life in modern society. It is a bulwark against poverty, and a building block of development, literacy is a basic human right. Literacy is the means through which every man, woman and child can realize his or her full potential."

Kofi Annan, 1997

In general, Northern Ireland (NI) has a lower level of educational attainment than the rest of the UK. It also has a higher number of people living in poverty. A 2018 report by the Joseph Rowntree Foundation Analysis Unit, titled "Poverty in N. Ireland", found that around 17% of the population (370,000) live in relative poverty compared to the UK figure of 16.7%. Of this number, 110,000 were children. The report states that the gap in educational attainment among richer and poorer children has narrowed slightly, but remains very large. There are also more people with no qualifications, and fewer people with higher level qualifications in NI than in the rest of the UK. NI also has had a consistently higher number of adults leaving education without qualifications, compared to the UK (17% compared to 9% in 2014).

Free school meal eligibility

Although not the only indicator, in the context of this thesis, disadvantage is measured by free school meal eligibility (FSME). Children can access free school meals if they meet certain criteria, including; if parents(s) access universal credit; income support; job seeker allowance or working tax credit. Using FSME as an indicator of disadvantage has been criticised for the fact it doesn't distinguish between levels of disadvantage, the fact it misses the "working poor in society" and the fact that it may underestimate the pool of disadvantage (Montemaggi, Bullivant and Glackin, 2017, Kounali, Robinson, Goldstein & Lauder, 2008).

However, Taylor, (2018) finds that as a proxy for disadvantage, eligibility for FSM comes very close to identifying socio-economically disadvantaged learners in a way that few other indicators can.

Educational attainment

Disadvantage undoubtedly impacts on educational attainment (Department of Education, 2019). Children from a disadvantaged background are more likely to live in cramped housing where they share rooms, are more likely not to have eaten before attending school, are less likely to have completed their homework and suffer from poorer attendance than their peers, will engage in more challenging behaviour aligned with poorer concentration and are more likely to be bullied for being poor. Disadvantaged children are therefore more likely to suffer barriers to learning, and one result of this is a higher level of literacy difficulties. According to the National Literacy Trust (2018), illiteracy costs the UK economy 36 Billion per year in lost earning, benefit payments and increase medical costs. There are links between low literacy and depression, obesity and life expectancy; a male born in the UK within an area experiencing high levels of literacy problems may have a life expectancy of up to 26.1 years less than an area without such literacy difficulties. The cycle of illiteracy often continues when people with poor literacy have children; they are unable to help with homework, more likely to be unemployed, socially isolated and suffer from lack of self-esteem and poor health.

School funding

To counter the impact of disadvantage, since 2011, UK Primary schools are eligible to receive increased funding for every pupil who has been registered for free school meals at any time in the last 6 years. This money is designated for the improvement of educational attainment and must be spent on activities designed to raise the attainment level of these

disadvantaged pupils. Schools spend this money as they see fit within this context: extra 1-1 lessons, increased numbers of teaching assistants, extra tuition, external specialist support such as speech and language therapy, equipment such as laptops, iPads, and ICT. Ofsted inspections measure and report on whether the school is spending the money "appropriately". However, the variation from school to school and the lack of clear direction from government regarding how the extra funding is spent makes it difficult to evaluate the impact or the overall effectiveness. Additionally, inconsistency in allocation of school funds will result in inconsistent outcomes and weakness in the relationship between student performance and school resources (Hanushek. 1997). Conversely, while Dewey, Husted and Kenny (2000) agree that not all school use their resources effectively, they suggest higher levels of funding do in fact result in a higher level academic performance. The fact that increased school resources may or may not result in improved pupil performance are indicative of the lack of a systematic, evidence-based approach to the purchase and use of educational resources. Levačić and Vignoles (2002) argue that until better empirical evidence on the impact of using resources in different ways becomes available, little guidance can be given to head teachers on how best to allocate their resources.

Literacy resources

While there is unanimous agreement between educators and researchers that targeting literacy skills at an early age is crucial to closing the literacy gap between disadvantaged children and their non-disadvantaged peers, the most effective method of doing so remains elusive to may schools. Many schools now provide additional literacy activities in addition to regular, teacher delivered classroom instruction. However, the cost of reading packages can often be prohibitive for primary schools; hardcopies of the Edmark Reading Program costs $1973.76/£1503.64, the Reading Milestones package costs $2193.96/£1671.39. Online reading programs are often seen as an answer to improving pupil performance in a more cost

and time effective manner. However, the cost can still be prohibitive: “ABC Mouse” online literacy program costs $100/£76.18 per pupil per year, “K5 Learning for Reading” costs $180/£137.13 per pupil per year. The Financial Times reports that by 2020 the global market for educational technology will grow to £129 billion. Schools in the UK spend £900 million per year on educational technology. In 2018, the British Educational Supplier Association (BESA) reported that spending within the 20,832 UK primary schools on ICT in 2019 will rise to £295.8 million. This equates to an average of £1419.93 per primary school. When distributed among the subjects on the curriculum, a limited amount of funding is available for each. As well as the challenge of choosing which subjects to allocate finite resources to, the efficacy of educational programs should play a key role in the purchasing decisions. Schools should aim for programmes with the highest level of educational impact based on empirical research for their investment. However, this is not straightforward and raises key questions: what counts as empirical research and how are teachers meant to know how to identify such evidence-based, peer reviewed research? As an example, the reading programmes mentioned previously (Edmark, K5 Learning for Reading, Reading Mouse and Reading Milestones) offer convincing parent testimonials and awards received to prove their effectiveness. To a busy primary school teacher with no background in research, this may well be sufficient evidence of effectiveness. Conversely, to someone who understands the concept of evidence-based practice the fact that none report empirical, tested and replicated data on their efficacy would mean there is a clear lack of evidence of efficacy. This is no way meant to suggest that all teachers fail to understand the need for empirical data; the question is how widespread that knowledge is and how prominent a factor is it when purchasing resources. A lack of reported empirical evidence does not of course mean that particular programs are not effective in improving reading, but a lack of such evidence suggests that no empirical studies have been conducted, or that the evidence is weak or does not support the use of a particular program.

The Education Trust (2010) suggested that although the claims for how technology can improve educational performance are widespread and influential, the evidence is actually extremely weak and the motives of those making these claims is often clouded. A key issue faced by educators is selection of the most effective and appropriate online resources to support pupils who are struggling with literacy? An existing evidence base of efficacy should be a key factor in selecting resources. As medicine required a cultural change away from the expertise of individual doctors to the use of evidence-based practice (Goldacre, 2013), education must follow suit and place a much greater value on the concept of an evidence base (Hargreaves, 1996).

Headsprout Early Reading

There are numerous ICT programs available covering many subject areas which incorporate a wide range of teaching methods and techniques. Computer assisted instruction (CAI) is a specific type of ICT which refers specifically to specific drill and practice programs. CAI presents information via text, videos, sound and graphics/animations then tests pupils understanding via games, problem solving and challenges. Headsprout Early Reading (HER) is one such CAI program with an increasing evidence base of efficacy. HER is an online, computer delivered reading program for children which teaches systematic phonemic awareness via individual episodes featuring animated characters, games, puzzles and schedule of rich reinforcement. There is an increasing evidence base of effectiveness for HER. It was developed by behaviour analysts to incorporate the 4 key learning frameworks consistent with effective instruction: reduced errors, mastery criterion, guided practice and cumulative review. HER incorporates the 5 sub skills identified by the National Reading Panel to enable children to master to become successful readers namely phonemic awareness, phonics, vocabulary development, reading fluency and reading comprehension. Whereas other reading programs often use a one size fits all approach, HER adapts and changes its

instruction based on the individual performance of the user. HER is consistent with the approach of Applied Behaviour Analysis instructional programmes in that clear learning outcomes are set; performance targets are high (90% correct required) and corrective feedback is provided continually based on the performance of the user. Lessons are called episodes and are set in various worlds such as Dinosaur and Space world. Reinforcement is provided verbally and by awarding stars which can be used to purchase character items at the end of each episode. HER claims to bring users to a proficient level of reading in 80, 20 minute episodes. HER has been evaluated in both school and home settings and with various cohorts of children, including typically developed children, those with intellectual disabilities, those with ASD and those from a care background (Layng, Twyman & Stikeleather 2003, 2004; Clarfield and Stoner 2005, Whitcomb, Bass & Luiselli, 2011; Grindle et al. 2013; Huffstetter et al. 2010, Tyler, Hughes, Beverley & Hastings, 2015; Storey, McDowell & Leslie, 2017, 2020). This research has consistently shown significant improvements in literacy performance with use of the HER program.

This study aimed to extend the current evidence base of HER by evaluating the impact on literacy skills of disadvantaged children attending mainstream primary schools in N. Ireland. The aim of this study was to investigate if the addition of HER to existing school-based literacy instruction could bring about significant improvement in literacy skills.

2.2 Method

Design

Previous studies of the effectiveness of HER used multiple baseline design (Cullen, Alber-Morgan, Schnell& Wheaton, 2014). However, the MBD requires baseline behaviour to be established and an intervention to be applied to one person or group at a time. The effect is measured after each application. Use of a MBD was not possible with this research for two

reasons: 1: Time constrains: this research had a time limit of 24 weeks of school term therefore schools had to begin the intervention at the same time. 2: It would take time for the HER to have an impact on literacy. Early assessments were unlikely to show any literacy improvements. Based on these considerations, the most appropriate design for this study was a repeated measure, between and within group research design. This allowed evaluation of the impact of HER on the literacy performance of disadvantaged primary school children. Quantitative data was obtained from the repeated measures of literacy assessments conducted with pupils in both the treatment and control groups. All pupils were assessed before intervention, at midpoint (approximately 12 weeks) and post intervention. Two assessments were used:

1. The Phonics Early Reading Assessment (PERA) (Appendix 5): a standardised reading test providing a sentence reading age and a phonics reading age.
2. Flashcard Identification Test (FIT) (Appendix 4): a bespoke phonics test which tested individual level of fluency for each pupil.

Setting

This research was carried out in 8 primary school in N. Ireland, coded 1-8. Schools were randomised to an intervention group or a waiting list control group at the pre-intervention stage by the process of simple randomisation. This allowed post intervention test results to be used to evaluate the impact of HER. This resulted in 5 schools (Schools 1-5) participating as part of the treatment group (n= 79) and 3 schools (School 6-8) in the control group (n=44). HER sessions were carried out at the 5 schools in the treatment group in various setting throughout the school such as computer suites, classrooms and corridors based on the available resources each day in each school. In each computer suite, seats were situated around the edge of the room. Pupils completed HER episodes on PC, Laptop or iPad. Each

school HER coordinator was responsible for timetabling HER on a weekly basis then and informing relevant staff of the days and times sessions were scheduled for pupils. The researcher was present at the first day of HER use in each school and then at various points throughout the research period.

Participants

Participants (n =123) were recruited for inclusion in the study if they met the following criteria:

i. They were attending Primary school at the beginning of the school year.
ii. They were availing of free school meals at the beginning of the school year.
iii. They had a reading age at least 1 year lower than their chronological age based on the results of the last annual GL Education Group literacy tests.

The majority of primary schools in N. Ireland use tests from the GL Education Group to assess pupil's performance in a range of subjects including English, Maths and Science. Literacy coordinators were asked to identify these pupils as they had access to individual GL Education Group test results. This data is considered personal data under General Data Protection Regulations (GDPR) and was therefore unavailable to the SI. Literacy coordinators were also provided with the outline and sequence of learning objectives of HER to review and assist pupil selection. Each school was asked to select at least 15 potential participants who met the inclusion criteria; some school provided more than 15 pupils and these were accepted to account for possible attrition such as pupils changing school or those who chose to leave the research project. As participants were under 18 years old, information and consent forms were distributed to their parent/guardian for completion. In addition, potential participants were provided a child friendly version of the information and consent form. Upon receipt of consent forms, the SI began arranging assessment days with each of

the 8 schools. Schools were randomly allocated to either the treatment or waiting list control group.

Table 2:1 Treatment group participant details

School	Participant number	Total Female (F)	Total Male (M)	**P2**		**P3**		**P4**		**P5**		**P6**		**P7**	
				F	M	F	M	F	M	F	M	F	M	F	M
1	16	8	8	4	1	2	4	0	3	0	0	2	0	0	0
2	17	9	8	4	2	2	3	3	3	0	0	0	0	0	0
3	13	6	7	0	0	2	3	3	2	1	2	0	0	0	0
4	15	9	6	0	0	1	3	8	3	0	0	0	0	0	0
5	18	11	7	0	2	7	4	1	1	1	0	1	0	1	0
Total	79	43	36	8	5	14	17	15	12	2	2	3	0	1	0

Table 2.1 shows the number of pupils in each treatment group school, which class they were in and whether they were male or female.

Table 2:2 Control group participant details

School	Participants	Total Female (F)	Total Male (M)	**P2**		**P3**		**P4**		**P5**		**P6**		**P7**	
		F	M	F	M	F	M	F	M	F	M	F	M	F	M
6	15	9	6	4	1	3	3	2	2	0	0	0	0	0	0
7	14	6	8	0	0	4	3	2	5	0	0	0	0	0	0
8	15	6	9	0	0	6	5	0	2	0	2	0	0	0	0
Total	44	21	23	4	1	13	11	4	9	0	2	0	0	0	0

Table 2.2 shows the number of pupils in each control group school, which class they were in and whether they were male or female.

Schools 1-5 in the treatment group began the HER intervention immediately after all school assessments were completed and ethical approval had been received from the Ulster University Research Ethics Committee. Schools in the control group would be offered free Headsprout licences for one year for up to 36 pupils at the end of the research. Assessment would provide key baseline data for each of the 123 participants. In preparation for baseline assessments the researcher practiced the assessment on 5 primary school children of a similar age to those on the project to gauge how long they would take and to identify any problems with assessment. Based on these practice assessments, the researcher concluded each assessment would take between approximately 20 minutes per pupil. For 15 assessments, a full school day would be required.

Materials

Pupils required access to either a Laptop, PC, iPad/Tablet with a wired/Wi-Fi internet connection to access the HER program. All participants accessed HER via a combination of Laptops and iPad. Each participant also had access to headphones to ensure they could clearly hear all program instructions. The school HER coordinators were present while pupils used the program. Although HER works with each user as an individual and adapts its instruction based on individual performance, the HER coordinator's role was to help with any technical issues such as login problems, charging computers and providing access to headphones. Additionally, the HER coordinator was responsible for maintaining on task behaviour during HER sessions using verbal prompts. If noise and off task behaviour occurred, teachers were instructed to briefly intervene, and redirect, as they would in a normal class.

HER coordinators were also advised to ensure where possible that each pupil used the same iPad for HER as if a pupil forgot to logout at the end of an episode, another student could potentially work under their username by mistake. At the outset, the researcher asked treatment schools to commit to 4 episodes per pupil per week at approximately 30 minutes per episode.

Procedure

Ethical approval - Ethical approval for this project was sought and received from Ulster University's University Research Ethics Committee (UREC) (Appendix 1). In designing this research project, the researcher referred to the Behaviour Analyst Certification Board's (BACB) Professional and Ethical Compliance Code for Behaviour Analysts, 2016 throughout. Participation was informed and voluntary. All participants were informed of their right to withdraw the research at any time as well all having access to their information whenever requested. Schools and pupils were anonymised to prevent possible identification and confidentiality was always maintained. No data was shared on social media about schools or participating pupils. All collected data was entered onto an Excel spreadsheet which was coded for anonymity and password protected.

Recruitment

Recruitment took place within N. Ireland primary schools which had an above average number of children availing of free school meals (FMS). The average number of children eligible for FMS per school was 29.7% in N. Ireland in 2017. It was therefore agreed between the SI and CI that only schools with an eligibility above this number would be used as part of the project. The researcher only contacted schools in Coleraine, Derry and Strabane for an expression interest as these were within reasonable driving proximity from both Ulster University and the researcher's home address. This maximised time available for the

researcher to travel to and between schools regularly to carry out assessments and to offer ongoing guidance and support. The Department of Education lists details of all NI schools including the percentage eligible for FSM. From this, the researcher was able to identify primary schools that fitted the criteria of location and free school meal eligibility. A total of 64 schools in Derry, Strabane and Coleraine were eligible for participation based on the agreed criteria for inclusion. The researcher created a promotion pack of materials (Appendix 2) which was sent to the principal and literacy coordinator in each eligible school. This pack contained the following:

- Letter to school: Introduction to the researcher and an invitation to join the project.
- Better Reading for Better Outcomes information sheet: An outline of the research question, why the school is being asked to take part, what does the study involve, timescale, required resources, how results will be analysed, benefits and risks, data protection, key contact details.
- Easy to read pupils information sheet: Brief outline of the project and the HER Early Reading Program.
- Parent's information sheet: Program outline, timescale and potential benefits.
- Expression of interest form in a stamped addressed envelope: To be returned to research if the school wished to join the project.

School staff were informed that completion of the expression of interest form was not a firm commitment to join the project, rather a request for a further information. An Excel database was created to track which schools had been sent a promotion pack and which responded. Schools were coded for anonymity. 10 days after the promotion packs were sent a follow up courtesy call was made to each school to confirm they had received the pack and to probe for interest. Within 2 weeks of postal of promotion packs, 12 expression of interest forms were received (18.75% of schools targeted). The researcher subsequently contacted each interested

school to arrange a meeting to discuss the project further. It was suggested by the researcher that the Principal should attend these meetings; they would be the person responsible for ultimately deciding if they wanted to participate and subsequently allocating staff and resources to the project. The SI and Chief Investigator (CI) attended each meeting. The researcher began by providing a verbal outline of the project including the background, aim, duration and school requirements. Noted questions from teachers were as follows:

- How many times a week the intervention take place?
- When could control group-participants access Headsprout?
- What evidence existed for Headsprout's efficacy?
- What equipment is needed to run Headsprout?
- What type of pupils were the research team were interested in?
- What support would be offered by the research team during the project?

At the end of each meeting the researcher asked the school principal to confirm participation within 1 week. The meetings took place over a period of 3 weeks. Eight schools subsequently confirmed participation on the project.

Each school was asked then asked to appoint a HER coordinator for the duration of the project. The student researcher immediately forwarded consent forms to each school; one to be signed by the principal and one to be signed by both participating pupils and their parents. 6 of the 8 participating schools asked the researcher to carry out a presentation to all staff on the research project. This was to ensure staff were aware of the requirements on any of their pupils who were participating. Presentations were carried out over a 2 week period and involved a 15 minute presentation outlining the research project followed by a question and answer session. Following these presentations, the researcher met with the literacy coordinator to specify the inclusion and exclusion criteria, to allow them to identify children

to be included in the research. Initial screening of potential participants was carried out by the literacy coordinator based on this information, and on their knowledge of children's literacy test results in school. It was reinforced at this stage that participants must have identified literacy difficulties based on GL scores rather than solely the subjective opinion of the literacy coordinator.

Pupils identified were then were given a project outline via an easy to read sheet (Appendix 2) and this was also explained to them by the HER contact in each school. This person was also responsible for discussing the project with any parents who enquired having been briefed by the SI on the key details. Parents were also informed that they could avail of an information session with the researcher, however, no parents requested this. When each school had recruited the minimum number of participants (15), the researcher went to each school and met each pupil to discuss the project, what it would entail and to answer any additional questions.

Teacher training

The student investigator visited each school in the treatment group to train relevant staff in the use of Headsprout. The SI designed a user manual (Appendix 3) which was used as the training resource for each teacher. The user manual contained information on setting up the program, ongoing fidelity checks such as benchmark assessments, reading out loud and ensuring 90% accuracy throughout, managing students and available teachers' resources. During the training the SI:

- Demonstrated how to load Headsprout onto iPad/Tablets or alternatively, access the program through the website for Laptops and PCs.
- Demonstrated how to add students, changes episodes and check progress reports for each user.

- Identified the HER benchmark assessments to complete every 10 episodes with participants and how to check progress and student accuracy throughout.
- Discussed possible incentive programmes for pupils based on episode completion.
- Discussed HER's inbuilt correction procedure and how the teacher's role is to ensure students remained on task rather than interacting with the program.
- Suggested that each pupil used the same iPad throughout for easier access and consistency. The SI attended each school's first day of using HER to offer support and help overcome any initial problems that arose.

Research Assistants

Three Psychology undergraduate students from Ulster University were recruited as research assistants (RAs) to assist the SI with the school assessment. The SI trained the RAs in the assessment protocols and then had each RA practice a full set of assessment on each other to ensure competency. The RA role was solely supportive of the SI.

Assessment

Pre intervention literacy skills were assessed via two forms of assessment:

1. The Flashcard Identification Test (FIT) (Appendix 4).

2. The Phonics Early Reading Assessment (PERA) (Appendix 5).

Flashcard Identification Test

The Flashcard Identification Test (FIT) was designed to measure participant's fluency in identifying the relationships between graphemes (written letters) and phonemes (spoken sounds) for the 44 phonemes that make up the English language. These 44 phonemes are represented by combinations of the 26 letters of the alphabet. Phonemes become more challenging as more letters are combined and rules of exception are included such as the

sounds made by “igh” or “ough”. These 44 phonemes are taught as part of the curriculum in primary schools in N. Ireland by the end of primary 2, therefore none of the phonemes in the FIT assessment should have been novel to any participants. Headsprout incorporates these 44 phonemes into the 80 episodes of its teaching system. Each of the 3 tests contained 50 cards, and pupil’s performance on seeing and saying the sound combinations were timed for 1 minute. Each 1 minute timing therefore provided a correct and incorrect rate of responding on the set of sounds tested. The level of difficulty increased from FIT 1 to FIT 2 and again from FIT 2 to FIT 3. Before the FIT test occurred, the SI carried out a training session with the 3 RAs to clarify the correct pronunciation of each sound used during the test. Each sound was read aloud by the researcher and repeated by the RAs. Each RA was then asked to say each sound aloud to ensure they knew and could demonstrate the correct pronunciation of each sound used in the test. Only the SI carried out assessments.

FIT Protocol

The Flashcard Identification Test (FIT) took the form of 3 x 1 minute tests: FIT-1, FIT-2 and FIT-3. Before each FIT, the researcher and the RA introduced themselves to each pupil and asked a few questions about the pupil’s hobbies and interests such as sports, computer games, and favourite Netflix shows to build rapport. A stopwatch on a mobile phone was used to time the test. During each test the researcher held up a flashcard with letter/letters written on it. The pupils were asked to say the letter sound rather than say the letter name. When the SI, RA and pupil were ready, the researcher started the stopwatch and held up the first card. The pack of assessment cards were held in the researcher’s right hand. Each card was turned over and held up in front of the pupil by the researcher’s left hand where both the pupil and the RA could see it. The RA was asked to sit beside the pupil opposite the researcher so they could score see the card and score the response. The RA was given a list of the sounds and the order they would come out to aid their scoring. The assessor placed the card in a

correct/incorrect pile based on the pupil's answer. Pupils were told that the researcher would place the cards in different piles and not to worry where they were put, just concentrate on the next card.

Correct and incorrect answers were tallied at the end of each 1 minute timing and said aloud by the researcher to compare with the RA. This would take the form of 2 number e.g. 21-4 with the first number the correct answers and the second the incorrect/no answer given score. This score was immediately compared to the score given by the RA. The researchers score was given priority, the RA's score allowed any potential inter-observe variation to be identified and discussed immediately. Any discussion occurred without the pupil hearing. During the test no verbal reinforcement or feedback was delivered. The 3 FIT assessments were carried out pre intervention, at midpoint and again post intervention on both the treatment and control groups.

Phonics Early Reading Assessment

The Phonics Early Reading Assessment (PERA) is a standardised phonics and early reading assessment which assesses the Department for Education (DfE) framework for letter and sound knowledge. PERA was developed by McCarty and Ruttle (2012) and is based on the user's ability to read a series of pre-determined words and non-words. PERA comprises five assessments including a non-standardised pre-phonics assessment for children who are not yet at the required reading level for the main PERA test. PERA takes approximately 10 minutes to administer to each child and tests phonemic awareness, fluency and vocabulary, all of which are essential elements for reading achievement. Part of the PERA is a comprehension test. This was not used in this research as letter and sound association knowledge was the key area of interest. RAs received training on administering the PERA. The researcher and the RA's read the instructions and carried out a mock test on each other to

familiarise themselves with the process and method of assessment. Each RA was asked to read a different amount of words correctly which allowed the researcher to demonstrate how to obtain a sentence reading age and a phonics reading age based on the PERA standardised scoring.

PERA Protocol

Each PERA was administered following completion of the FIT assessments during the scheduled session. The PERA contained 2 tests. The first test was the sentence reading age (SRA) assessment. Pupils were asked to read a short story from pre-designed double sided card which contained 50 words. No indication was given to the pupil if answers given were correct or incorrect. The SI ticked words pronounced correctly and put an X beside those that were not. The word on which the pupil made their 5th error would indicate their sentence reading age in years and months.

The second PERA assessment used was the phonics reading age (PRA) test. Pupils were asked to read 50 words spread over 3 sides of pre-designed A4 cards. A combination of real and nonsense words such as "sorb" were used. There was no time limit set to read each card. The total number of correct answers provided by a pupil out of 50 was cross referenced to a scoring table of established norms which would provide a phonics reading age in years and months. RA's were once again asked to score independently to allow to test for inter-observer agreement. The IOA process was the same as for the FIT assessment, any variation was discussed between the researcher and the RA. The student investigator's score was given priority. Assessment were carried out over a full school day. Schools were asked to provide a quiet room to allow the tests to be carried out. The data obtained was transferred onto an Excel database the same day the results were obtained. Each pupil and school were anonymised. Each assessment was attended by the researcher and a RA.

Assessments were conducted as follows:

1. **Assessment period 1:** Baseline performance assessment in 8 schools using PERA and FIT. (HER intervention was then introduced in 5 treatment group schools following this assessment phase).
2. **Assessment period 2:** Midpoint performance probe in 8 schools using FIT**.**
3. **Assessment period 3:** Post intervention assessment in 8 schools via the PERA and FIT.

Each assessment session lasted approximately 20 minutes per pupil. Pupils were given clear verbal instructions of what they were being asked to do for each section of the assessment. Shorts breaks were offered to any pupils who required them during the assessment.

Inter Observer Agreement

FIT IOA

The FIT IOA was calculated by dividing the number of answers to FIT cards that both the SI and RA agreed upon into the total number of answers asked. This number was then multiplying by 100 to get a percentage correct accuracy.

Example: 39 answer agreed out of 40 questions asked: 39÷40 = 0.975 × 100 = 97.5% IOA.

PERA IOA

- Sentence Reading Age IOA was determined by identifying the 5th word on a page on which the pupil made an incorrect/no pronunciation response. For IOA to be met, both the SI and RA were required to agree on this word based on the pupil pronunciation.
- Phonics Reading Age IOA: Word and non-word recognition: The IOA was calculated by dividing the agreed number of correct answers by the total number of words

presented. This number was then multiplying by 100 to get a percentage correct accuracy. Example: 47 answer agreed out of 49 questions asked: 47÷49 = 0.959 × 100 = 95.91% IOA.

Midpoint assessment.

Participants in each of the 8 schools were assessed using the FIT at midpoint of the project. The protocol of the midpoint FIT was the same as baseline, whereby participants were shown a flashcard with a letter or letters, and asked to say the sound the letter/s made during a 1 minute timing. Again, no feedback or reinforcement was delivered.

Post Intervention assessment

This process of assessment mirrored that of the baseline assessments. A research assistant was present for each assessment.

Data analysis

Statistical analysis was conducted using SPSS on the data obtained. Independent sample t-tests were conducted to compare pre and post-test SRA and PRA scores for the treatment and control groups. A one-way ANOVA has been used to analyse FIT scores at pre, mid and post treatment.

Treatment and control groups

All schools were contacted by e-mail to inform them whether they were in the treatment or control groups following the process of simple randomisation. Schools in the control group were informed that they could begin using HER at the beginning of the next school year free of charge, with SI support. Schools in the treatment group were informed the following process would occur following receipt of UUREC ethical approval and required consent forms:

1. The researcher would visit the school at an agreed date to train staff on how to load the software onto laptops and/or iPad in conjunction with the appointed HER coordinator. This would be followed by a training session on the requirements of the HER programme including ongoing assessments, optional extras and support materials contained within the programme.
2. The HER coordinator would load participating pupils' details onto the HER programme and assign usernames and passwords.
3. The HER coordinator would talk to relevant members of staff to ensure each participating pupil would have suitable time allocated to complete the required number of episodes per week.
4. At pre agreed dates outlined by the researcher, pupils would begin the programme and aim to complete a minimum of 4 episodes per week.
5. The researcher would contact schools on an ongoing basis to offer support and to carry out midpoint testing when required.

Exclusions

Of the 123 pupils in the study, 27 achieved baseline PERA sentence/phonics reading ages at a higher level than required. The results for these pupils were therefore not included in the PERA results analysis. As the FIT assessment was testing rate of response, no pupil's results were excluded from analysis. The PERA analysis numbered n= 96, the FIT n=123.

2.3 Results

The aim of this study was to investigate whether the addition of HER to existing school-based literacy instruction could bring about significant improvement in literacy skills for children with literacy difficulties. Eight schools participated and were randomly assigned to either a treatment or control group. Assessments were carried out with each pupil to establish a sentence reading age (SRA), phonics reading age (PRA), and measure phonics fluency with a flashcard identification test (FIT).

Statistical analysis was conducted using SPSS version 25 on the data obtained. Independent sample t-tests were conducted to compare pre and post-intervention SRA and PRA scores for the treatment and control groups. A significance level of $p < .01$ was set to reflect the number of tests carried out. The SRA and PRA results of 27 pupils were excluded from the PERA assessment as their baseline performance demonstrated a sentence reading age above that required for this part of the study. School were asked to select pupils with a SRA at least one year below their chronological age. The 27 pupils who did not meet this criterion were excluded. The process of simple randomisation resulted in five schools in the treatment group and three schools in the control group.

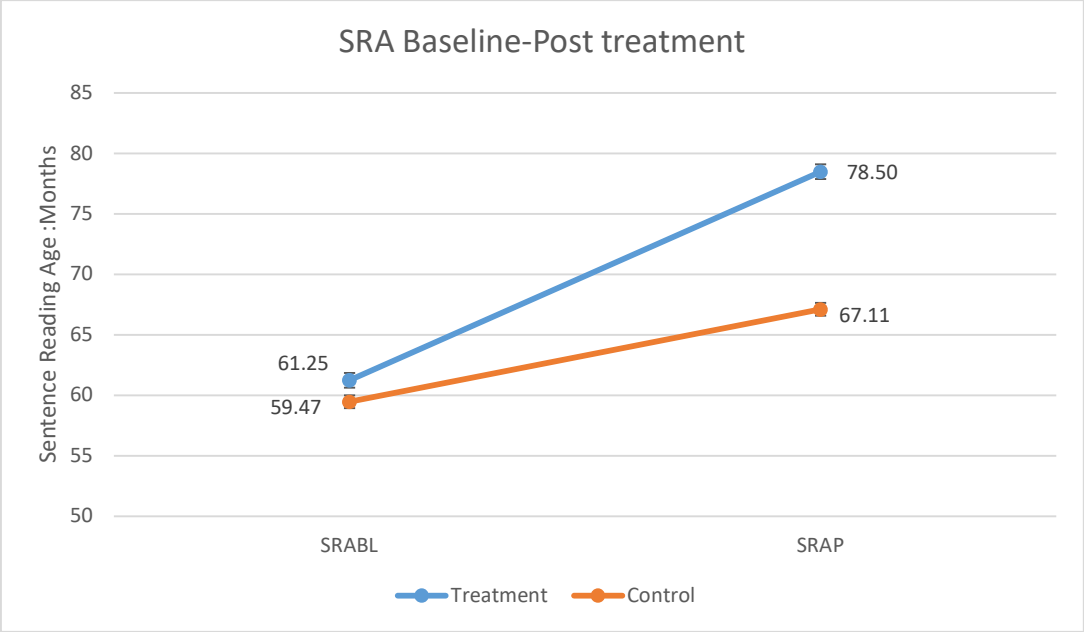

Figure 1.1 Mean SRA and standard error at baseline and post intervention for Treatment and Control groups.

Table 2.3 Mean SRA and standard error at baseline and post intervention for Treatment and Control groups.

	Group	N	Mean	Std. Deviation	Std. Error
SRA at Baseline	Treatment	57	61.25	4.603	.610
	Control	38	59.47	3.269	.530
SRA at Post Intervention	Treatment	54	78.50	8.271	1.126
	Control	37	67.11	9.306	1.530

Figure 1.1 and Table 2.3 show the group mean SRA scores taken at baseline and post intervention for the pupils in the treatment group (n=57) and the children who had teaching as usual in the control group (n=39). As seen in the figure, there was a marked increase in mean SRA of 17.25 months from 61.25 months to 78.50 months for the pupils in the treatment

group (n=57). There was also an increase in mean SRA for pupils in the control group of 7.64 months from 59.47 months to 67.11 months (n=39). The treatment group increased its SRA by 125% more than the control group.

Independent sample t-test showed no significant difference in SRA between the treatment group (M= 61.25, SD=4.603) and the control group at baseline (M=59.47, SD=3.269); t(93)=2.193, NS. Independent sample t-test showed a significant post intervention difference in SRA between treatment group (M= 78.50, SD=8.271) and control group (M=67.11, SD=9.306); t(89)=5.98, p = 0.0001.

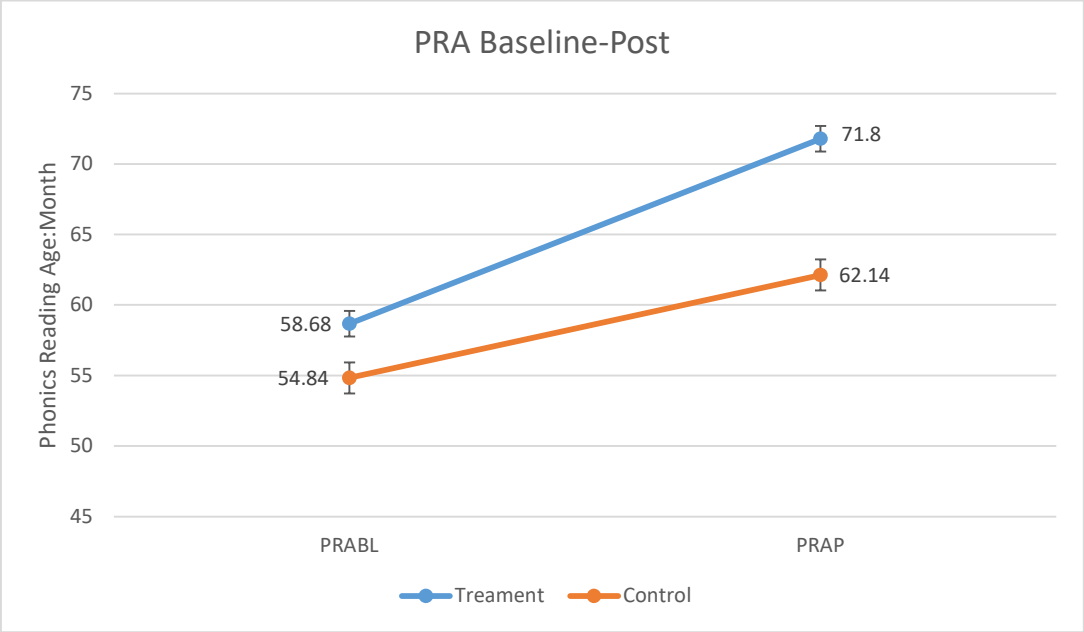

Figure 1.2 Mean PRA and standard error at baseline and post intervention for Treatment and Control groups.

Table 2.4 Mean Phonics Reading Age, standard deviation and standard error for treatment and control groups at baseline and post-intervention.

	Group	N	Mean	Std. Deviation	Std. Error
PRA at baseline	Treatment	57	58.68	6.840	.906
	Control	38	54.84	7.085	1.149
PRA at post intervention	Treatment	54	71.80	8.057	1.096
	Control	37	62.14	9.540	1.568

Figure 1.2 & Table 2.4 show the group mean PRA scores taken at baseline and post intervention for the treatment group (n=57) and the children who had teaching as usual in the control group (n=39). As seen in the figure, there was a marked increase in mean PRA of 13.12 months from 58.68 months to 71.80 months for the pupils in the treatment group

(n=57). There was also an increase in mean PRA for pupils in the control group of 7.30 months from 54.84 months to 62.14 months (n=39). However, the increase in PRA in treatment group was 79% more than that of the control group (13.12 vs 7.3)

An independent sample t-test showed no significant difference in PRA between treatment (M= 58.68, SD=6.840) and control group (M=54.84, SD=7.085); t(93) =2.625, NS at baseline. An independent sample t-test showed a significant difference PRA between the treatment group (M= 71.80, SD=8.057) and control group (M=62.14, SD=9.540); t(89)=5.049, p=.0001 post-intervention.

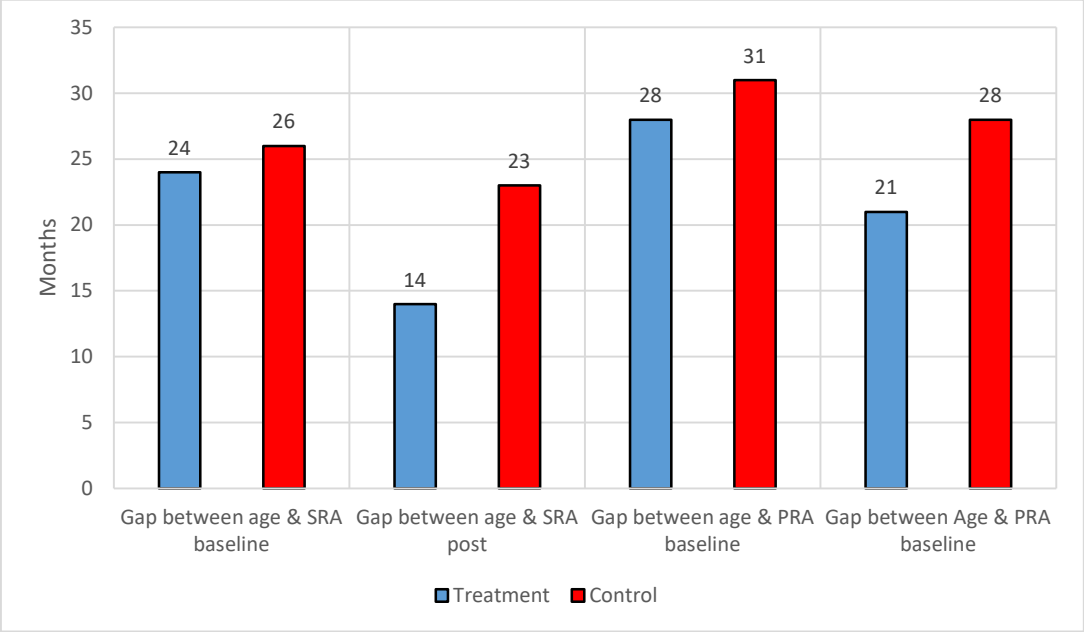

Figure 1.3 Mean gap between chronological age and SRA/PRA in months from baseline to post intervention for treatment and control groups.

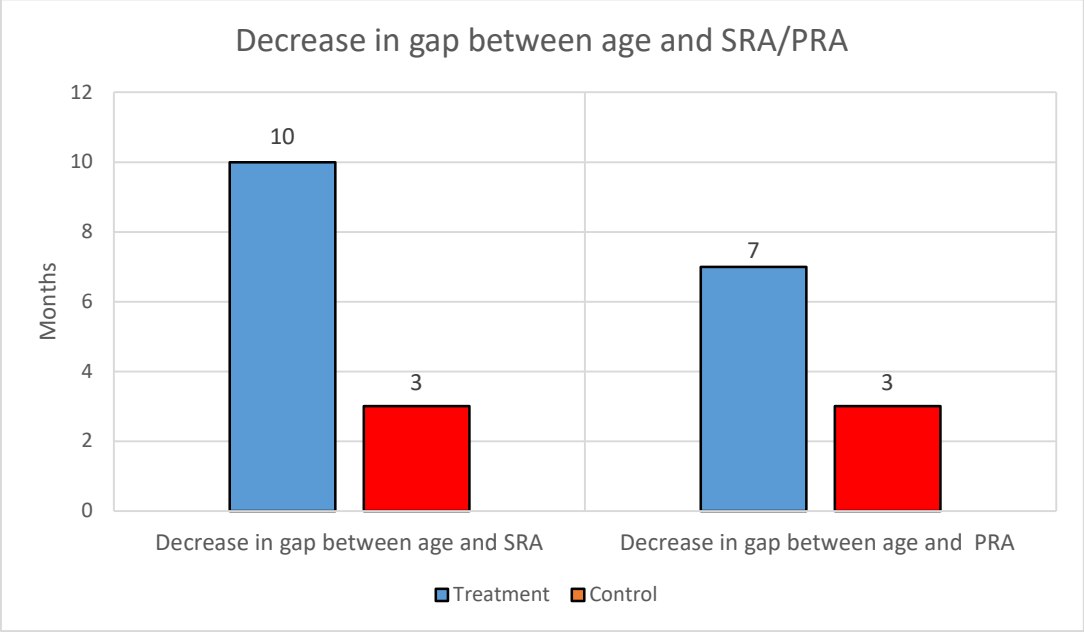

Figure 1.4 Mean decrease in the gap between age and SRA or PRA in months from baseline to post intervention for treatment and control groups.

Figures 1.3 and 1.4 show that both groups at baseline had large and similar gaps between their mean chronological age and SRA scores (24 or 26 months) and PRA scores (28 or 31 months) but at the end of the study the gap had closed markedly for the treatment group but

not the control group. This is illustrated in Figure 1.4 showing a decrease in the gap between the chronological age and the SRA of 10 months and PRA of 7 months for the treatment group over a six month period. This compares to a decrease of 3 months for both SRA and PRA in the control group over the same period.

Flashcard Identification Test (FIT) Results

The FIT measures were conducted at baseline, midpoint and post-intervention. Mean scores for treatment and control groups of correct and incorrect responses at these 3 time points for FIT1, FIT2 and FIT 3 are shown in Table 2.5

Table 2.5 Mean and standard deviation of correct and incorrect scores for FIT 1, 2 & 3 at baseline, midpoint and post-intervention time points for treatment and control groups.

Baseline				
	Treatment	Std. Deviation	Control	Std. Deviation
FIT 1 Correct	16.94	6.340	16.09	7.643
FIT 1 Incorrect	5.10	3.719	5.52	3.776
FIT 2 Correct	16.23	5.799	12.89	7.362
FIT 2 Incorrect	6.99	3.362	8.16	4.367
FIT 3 Correct	8.09	4.262	6.07	5.101
FIT 3 Incorrect	12.45	4.855	13.27	5.517
Midpoint				
	Treatment	Std. Deviation	Control	Std. Deviation
FIT 1 Correct	30.32	8.357	20.43	8.434
FIT 1 Incorrect	1.24	1.432	4.52	3.359
FIT 2 Correct	25.24	7.108	19.14	8.348
FIT 2 Incorrect	3.42	2.282	5.60	3.883
FIT 3 Correct	13.78	6.065	10.95	5.979
FIT 3 Incorrect	8.78	3.252	11.29	5.052

Post intervention				
	Treatment	Std. Deviation	Control	Std. Deviation
FIT 1 Correct	35.19	8.679	23.84	10.397
FIT 1 Incorrect	0.95	1.364	3.95	4.163
FIT 2 Correct	28.72	7.932	21	10.045
FIT 2 Incorrect	3.31	2.040	6.79	5.249
FIT 3 Correct	16.22	7.183	11.84	8.602
FIT 3 Incorrect	7.88	3.622	12.42	6.769

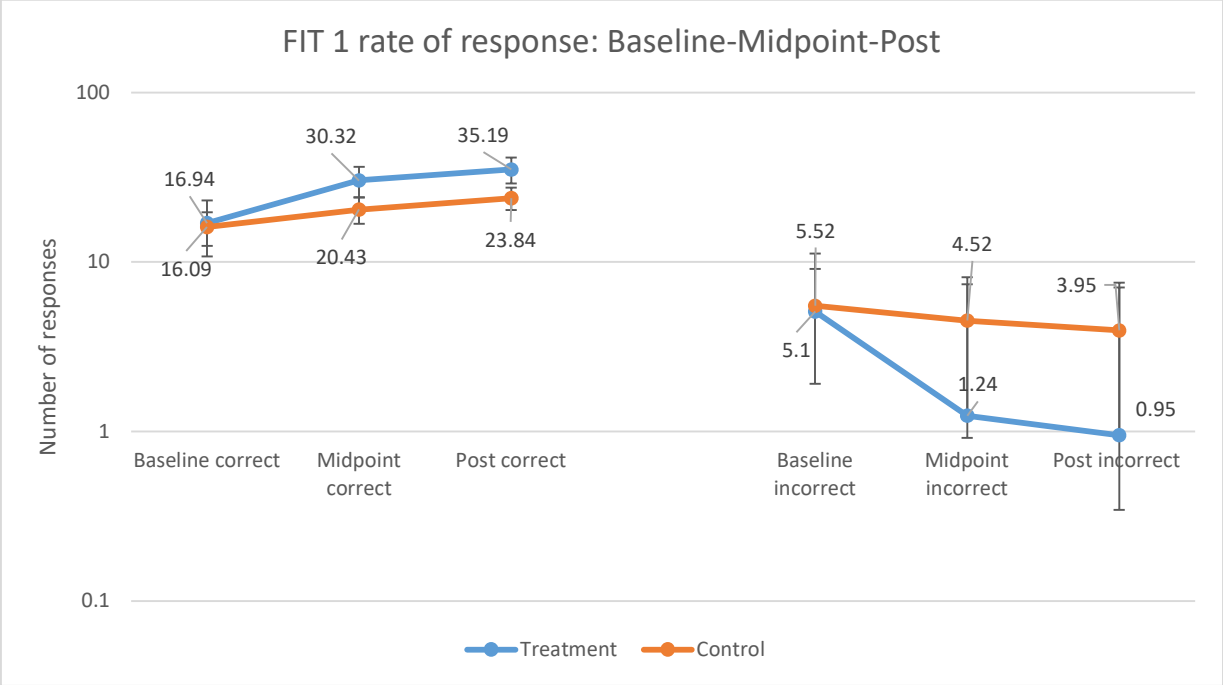

Figure 1.5 Mean total rate of response* at baseline-midpoint-post intervention and standard errors for treatment and control groups for FIT 1. Bars indicate standard deviation.

*Logarithmic scales have been used to illustrate FIT rate of response in Figures 1.5, 1.6 & 1.7. This is due to the fact each figure represents the variation in the rate of both correct and incorrect answers which ranged from under 1 to over 35 responses per minute.

Figure 1.5 shows that the treatment group increased the rate of correct answers and decreased the rate of incorrect answers to a greater extent than the control group for FIT 1. The treatment group increased the rate of correct answers from 16.94 at baseline to 30.32 at midpoint, then to 35.19 at post-intervention. The control group also increased its correct answers but at a lesser rate, 16.09 at baseline to 20.43 at midpoint, then to 23.84 at post intervention. The treatment group decreased incorrect answers from 5.1 at baseline to 1.24 at midpoint, then to 0.95 at post intervention. The control group also reduced incorrect answers but at a lesser rate from 5.52 at baseline to 4.52 at midpoint then to 3.95 at post intervention.

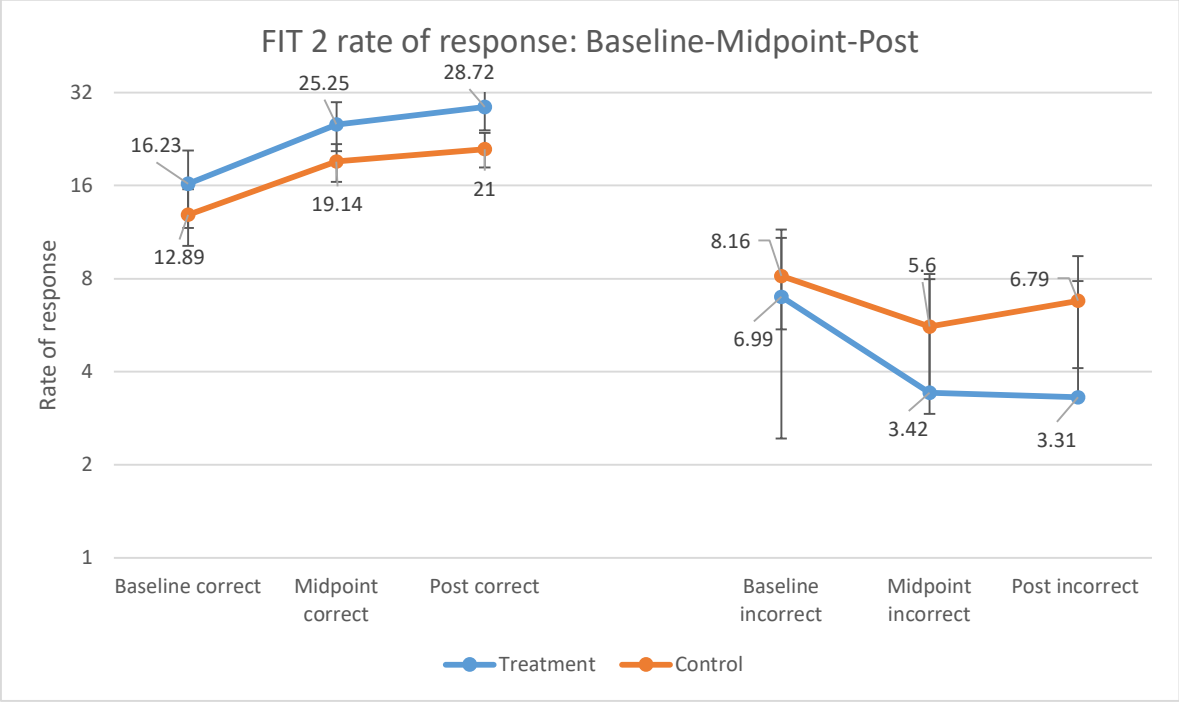

Figure 1.6 Mean total rate of response at baseline-midpoint-post intervention for treatment and control groups for FIT 2. Bars indicate standard deviation.

Figure 1.6 shows that the treatment group increased the rate of correct answers and decreased the rate of incorrect answers at a higher rate than the control group for FIT 2. The treatment group increased the rate of correct answers from 16.23 at baseline to 25.25 at midpoint, then to 28.72 at post intervention. The control group also increase its correct answers but at a lesser rate, 12.89 at baseline to 19.14 at midpoint, then to 21 at post intervention. The treatment groups decreased incorrect answers from 6.99 at baseline to 3.42 at midpoint, then to 3.31 at post intervention. The control group also reduced incorrect answers from baseline to midpoint from 8.16 at baseline to 5.6 at midpoint. However, the control group's rate of incorrect answers increased from midpoint to post intervention from 5.6 to 6.79.

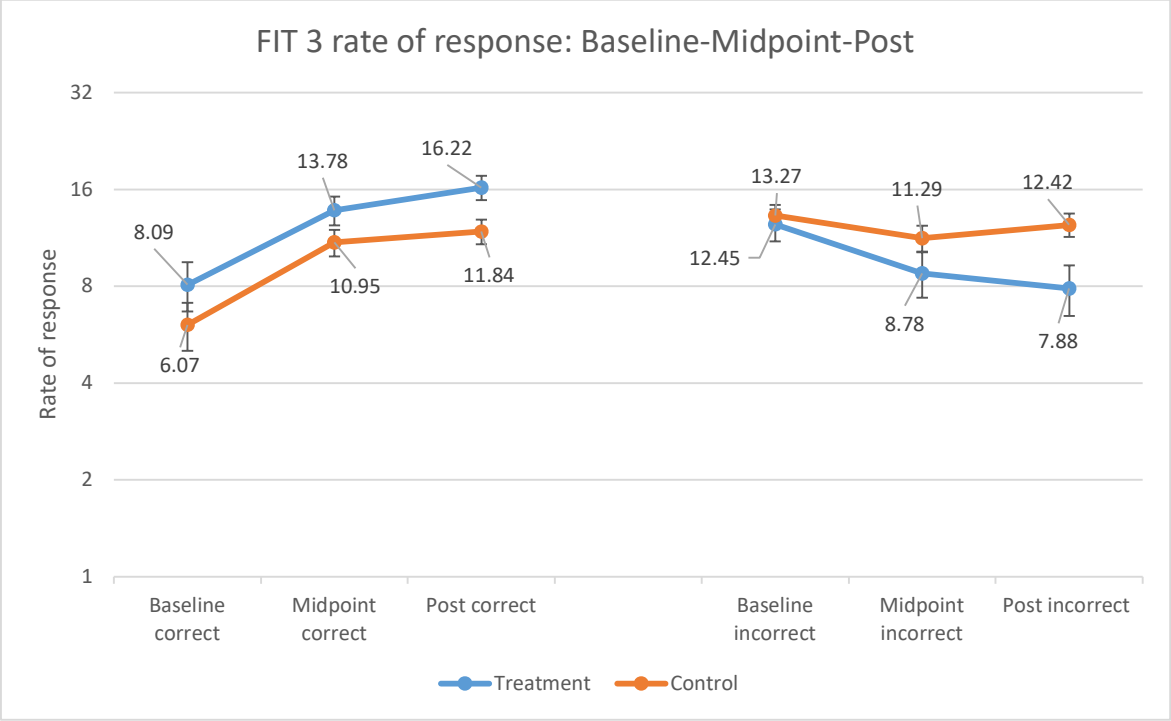

Figure 1.7 Mean total rate of response at baseline-midpoint-post intervention for treatment and control groups for FIT 3. Bars indicate standard deviation.

Figure 1.7 shows that the treatment group increased the rate of correct answers and decreased the rate of incorrect answers at a higher rate than the control group for FIT 3. The treatment group increased the rate of correct answers from 8.09 at baseline to 13.78 at midpoint, then to 16.22 at post intervention. The control group also increase its correct answers but at a lesser rate, 6.07 at baseline to 10.95 at midpoint, then to 11.84 at post intervention. The treatment groups decreased incorrect answers from 12.45 at baseline to 8.78 at midpoint, then to 7.88 at post intervention. The control group also reduced incorrect answers from baseline to midpoint from 13.27 at baseline to 11.92 at midpoint. However, as with FIT 2, the control group saw an increase in the rate of incorrect answers from 11.29 at midpoint to 12.42 at post intervention.

Correct Scores

A 3-way ANOVA was conducted on the correct scores, with 2 within-subject factors (FIT measure, and time point) and 1 between subject factor (group). There was a main effect of FIT measure ($F = 685.5$, df 2, 448, $p < .0001$) showing that the three measures differed in difficulty, a main effect of time, showing that scores changed across time ($F = 260.9$, df 2, 448, $p < .0001$) and a main effect of group ($F = 18.41$, df 1, 112, $p < .0001$) showing that scores differed between groups.

There were two-way interactions between FIT measure and group ($F = 18.18$, df 2 224, $p < .0001$), time and group ($F = 19.36$, df 2 224, $p < .0001$), FIT measure and time $F = 31.27$ df 4 224, $p < .0001$) and a three-way interaction between FIT measure, time and group ($F = 20.74$, df 4 448, $p < .0001$). Scores decline from FIT1 through FIT2 to FIT3; scores increased from baseline to midpoint to post intervention; scores are higher for the HER group than for control group; scores increased more across FIT measures for the HER group than for the control group; scores increased more across time points for the HER group than for the control group and scores increased more across time for FIT1 than for FIT2 or FIT3.

To further understand the differences, independent samples and paired-sample t-tests were carried out as appropriate.

Table 2.6 Paired sample ttest results of baseline to midpoint correct scores and midpoint to post intervention correct scores for each FIT measure for each group.

	Treatment **baseline-midpoint** t values	Sig. value	Treatment **midpoint - post** intervention t values	Sig. value	Control **baseline-midpoint** t values	Sig. value	Control **midpoint-post** intervention t values	Sig. value
FIT1	-15.25	p<.0001	-6.964	p<.0001	-5.731	p<.0001	-5.465	p<.0001
FIT2	-13.91	p<.0001	-5.16	p<.0001	-5.128	p<.0001	-8.928	p<.0001
FIT3	-9.105	p<.0001	-4.504	p<.0001	-7.003	p<.0001	-1.651	NS

Table 2.6 shows there was a significant difference in scores from baseline to midpoint and midpoint to post intervention for both the treatment and control groups for FIT 1-3 except for midpoint to post intervention for the control group for FIT 3.

Table 2.7 Independent sample t-test results of between group differences for FIT 1-3 correct scores at baseline, midpoint and post intervention.

Assessment:	Sig. (2-tailed)
Baseline FIT 1 Correct	.515/NS
Baseline FIT 2 Correct	.012/NS
Baseline FIT 3 Correct	.021/NS
Midpoint FIT 1 Correct	.0001
Midpoint FIT 2 Correct	.0001
Midpoint FIT 3 Correct	.0001
Post FIT 1 Correct	.0001
Post FIT 2 Correct	.0001
Post FIT 3 Correct	.004

Table 2.7 shows there was no significant difference in scores between the treatment and control group in FIT 1-3 correct scores at baseline. At all subsequent time points and on all FIT assessments there was a significant difference between the groups.

Incorrect Scores

A 3-way ANOVA was conducted on the incorrect scores, with 2 within-subject factors (FIT measure, and time point) and 1 between subject factor (group).

There was a main effect of FIT measure ($F = 679.8$, df 2, 448, $p < .0001$) showing that the three measures differed in difficulty, a main effect of time, showing that scores changed across time ($F = 45.61$, df 2, 448, $p < .0001$) and a main effect of group ($F = 18.81$, df 1, 112, $p < .0001$) showing scores were different between groups. There was no significant two-way interactions between FIT measure and group ($F = 0.314$ df 2 224, NS) or between FIT measure and time ($F = 1.464$ df 4 224, NS), but there was a significant two-way interaction between time and group ($F = 10.70$, df 2 224, $p < .0001$), and a three-way interaction between FIT measure, time and group ($F = 3.024$, df 4 448, $p = .028$). To further understand the differences, independent samples and paired-sample t-tests were carried out as appropriate.

Table 2.8 Paired sample ttest results of baseline to midpoint incorrect scores and midpoint to post intervention incorrect scores for each FIT measure for each group.

	Treatment **baseline-midpoint** t values	Sig. value	Treatment **midpoint - post intervention** t values	Sig. value	Control **baseline-midpoint** t values	Sig. value	Control **midpoint-post intervention** t values	Sig. value
FIT1	10.089	p<.0001	1.510	p<.135/ NS	1.146	p<.258/ NS	2.475	p<.018/NS
FIT2	9.123	p<.0001	0.202	p<.840/ NS	3.408	p<.001	-1.539	p<.132/NS
FIT3	6.179	p<.0001	2.430	p<.018/ NS	1.881	p<.067/ NS	-.949	p<.348/NS

Table 2.8 shows in the treatment group, there was a significant difference in incorrect scores from baseline to midpoint for FIT 1-3 but no significant difference in incorrect scores from midpoint to post intervention for FIT 1-3. In the control group, there was no significant difference in incorrect scores from baseline to midpoint or from midpoint to post intervention in FIT 1-3 except for FIT 2, baseline to midpoint.

Table 2.9 Independent sample t-test results of between group differences for FIT 1-3 incorrect scores at baseline, midpoint and post intervention.

Assessment:	Sig. (2-tailed)
Baseline FIT 1 Incorrect	.555/NS
Baseline FIT 2 Incorrect	.101/NS
Baseline FIT 3 Incorrect	.398/NS
Midpoint FIT 1 Incorrect	.0001
Midpoint FIT 2 Incorrect	.0001
Midpoint FIT 3 Incorrect	.005
Post FIT 1 Incorrect	.0001
Post FIT 2 Incorrect	.0001
Post FIT 1 Incorrect	.0001

Table 2.9 shows there was no significant difference between the treatment and control groups in FIT incorrect scores at baseline. At both subsequent time points and on all FIT assessments there was a significant difference between the groups.

There was considerable variation in the number of HER episodes completed by children in the treatment group, largely because of the quality and availability of technology and how schools approached the program implementation. See Chapter 3 discussion of this issue. It is possible this influenced the outcome variables. To test this possibility, all the children in the treatment group were categorised as how many sections of the HER course they completed within the study. If they completed less than 23 episodes they were scored 0 (n=2 in this category); if they completed 23 – 37 episodes they were scored 1 (n=28 in this category); if

they completed 38 - 54 episodes they were scored 2 (n=21 in this category); if they completed 55 – 79 episodes they were scored 3 (n=14 in this category); and if they completed all 80 episodes they were scored 4 (n=14 in this category).

A 3-way ANOVA was then conducted on the correct scores, with 2 within-subject factors (FIT measure, and time point) and 1 between subject factor (sections completed). There was no main effect of sections completed (F=0.636 df 1 4, NS), and no significant interaction between sections and FIT level (F=1.36 df 8 148, NS) or between sections and timepoint in the study (F=1.003 df 8 148, NS). A 3-way ANOVA was also conducted on the incorrect scores, with 2 within-subject factors (FIT measure, and time point) and 1 between subject factor (sections completed). There was no main effect of sections completed (F=1.092 df 1 4, NS), and no significant interaction between sections and FIT level (F=1.584 df 8 146, NS) or between sections and timepoint in the study (F=0.148 df 8 146, NS). We may therefore conclude that although the number of episodes completed varied and often fell well below 80, this did not significantly affect the FIT correct or incorrect scores.

2.4 Discussion

This aim of this study was to assess the impact of a systematic, phonics-based literacy program, Headsprout Early Reading, on the literacy performance of a treatment group of disadvantaged, underperforming pupils in comparison to teaching as usual. The sentence reading age (SRA), phonics reading age (PRA) and phonemic awareness fluency via a Flashcard Identification test (FIT) of a randomly allocated treatment group were compared to that of a control group of pupils receiving teaching as usual. Results of this study demonstrated that the Headsprout treatment group experienced statistically significant increases in SRA, PRA and FIT scores in comparison to the teaching as usual control group. Over a 6-month intervention period, the average increase in the SRA of pupils in the treatment group receiving Headsprout instruction was more than double (17.2 months) that of pupils in the control group (8 months). While the SRA of pupils in the control group increased at approximately 1.33 per month per month of teaching time, SRA of pupils in the treatment group increased at 2.86 months per month while using Headsprout.

Over the same 6-month period, the average increase in PRA in the treatment group receiving Headsprout instruction was 12.2 months, compared to 7.2 months in the control group. Whereas the PRA of pupils in the control group increased at approximately 1.2 months per month of teaching time, pupils in the treatment group increased at approximately 2.03 months per month while using Headsprout. For schools in the treatment group, each 1 month increase in PRA resulted in an average increase of an increase of 1.41 months of SRA. For schools in the control group each 1 month increase in PRA resulted in an average increase of an increase of 1.09 months of SRA. The results of the PERA also indicate the gap between the chronological age and reading age closed exponentially for the treatment group in comparison to the control group. The average chronological age at baseline was 90 months in the treatment group and 88 months in the control group. The mean gap between

chronological age and SRA at baseline was 24 months in the treatment group and 26 months in the control group. Over a six month period, the mean gap between chronological age and SRA in the treatment group had decreased by 10 months to 14 months (Treatment) and by 3 months to 23 months in the control group. Similarly, the mean gap between chronological age and PRA at baseline was 28 months in the treatment group and 31 months in the control group. Post intervention, the mean gap between chronological age and PRA had decreased by 7 months to 21 months in the treatment group and by 3 months 28 months in the control group. Over 6 months, pupils using HER experienced a 10 month and 7 month decrease in the gap between their age and their SRA and PRA. The control group experienced a 3 month decrease in the gap between their age and their SRA and PRA. The gaps between age and SRA/PRA closed exponentially in the treatment group. This accelerated learning is vital in the context of pupils who are struggling with literacy and falling behind the performance of their peers (Rose, 2009). In the control group, teaching as usual was not effective at closing this attainment gap; over 6 months the gap between age and SRA/PRA only decrease by 3 months. Predictions based on these results would indicate that over a full school year and beyond, this gap would continue to increase. This is what appears to be happening with children struggling with literacy. The gap appears early and continues to increase throughout school; figures from the Department of Education N. Ireland, (2015, 2019) support this. The ability of HER to close the gap in SRA/PRA in a relatively short period of time is therefore crucial.

The flashcard identification test (FIT) tested pupils' fluency in identifying the relationship between graphemes (written letters) and phonemes (spoken sounds). The results of the FIT tests mirror those of the SRA and PRA assessments, with pupils in the treatment group significantly outperforming control group pupils in all areas of the assessment. In each test at the midpoint and post intervention assessments, pupils the in treatment group performed at a

higher rate of response than pupils in the control group. From baseline to post intervention in FIT 1, pupils in the treatment group increased the rate of correct responses by an average of 18.25 per minute and decreased the rate of incorrect answers by a rate of 4.12 per minute. In comparison, pupils in the control group increased the rate of correct responses by 7.45 per minute and decreased the rate of incorrect responses by 1.27 per minute. For FIT 2, the treatment group increased the rate of correct answers by an average of 12.04 per minute and decreased the rate of incorrect answers by 3.56 per minute. In comparison pupils in the control group increased the rate of correct answers by 6.98 per minute and decreased the rate of incorrect answers by 0.8 per minute. For FIT 3, pupils in the treatment group increased the rate of correct answers by an average of 7.66 per minute and decreased the rate of incorrect answers by 4.47 per minute. In comparison pupils in the control group increased the rate of correct answers by 4.32 per minute and decreased the rate of incorrect answers by 0.93 per minute.

From baseline to post intervention the treatment group increased the rate of correct answers by 37.95 per 3 minute assessment (FIT 1-3) compared to a rate of 18.75 per 3 minute assessment for the control group. The treatment group also decreased the rate of incorrect answers per 3 minute assessment (FIT 1-3) by a rate of 12.15 compared to a rate of 3 per 3 minute assessment in the control group.

The midpoint was approximately 3 months into the intervention. The significant improvement in the overall results of the FIT assessments were made during the baseline to midpoint stage. 76% of the increases in correct answers for FIT 1, 74.83% for FIT 2 and 74.28% for FIT 3 were made in the baseline to midpoint stage. Similarly, 93.68% of the decrease in incorrect answers for FIT 1, 100% for FIT 2 and 82.10% for FIT 3 were made in the baseline to midpoint stage. This may be explained by the fact that Headsprout provides the majority of phonemic awareness teaching in episodes 1-40. Episodes 1-23 are called

"Cracking the Code" in which pupils are required to master basic phonemic skills such as blending and segmenting. Episodes 24-40 "Making sense out of reading" increases reading vocabulary to 500 words by introducing basic sentences which increase in length and complexity. Episodes 40-80 target compound words (two word coming together e.g. sun-flower) and non-sense words (sorb, vight) as well as introducing aspects of reading comprehension. Pupils completing at least the first 40 episodes benefitted in terms of improvements in phonemic awareness which support the findings of previous studies (Huffsteder et al, 2010; Twyman, Layng & Layng, 2011) that partial completion of Headsprout still results in significant literacy gains. Although further improvements were noted from the midpoint to post intervention stage (24% of the increases in correct answers for FIT 1, 25.17% for FIT 2 and 25.72% for FIT 3; 6.32% of the decrease in incorrect answers for FIT 1, 0% for FIT 2 and 17.90% for FIT 3), the largest improvements in performance were noted between baseline and midpoint. These results were mirrored in the control group where pupils also made the largest gains in increases in correct answers and decreases in incorrect answers from the baseline to midpoint stage. Although the treatment group significantly outperformed the control group in all aspects of assessment, the fact that the largest performance improvement were seen in both groups from baseline to midpoint requires further enquiry. Within this study, baseline to midpoint represented 12 weeks from January-April 2019 and midpoint to post intervention represented 12 weeks from April-June 2019. The Easter holidays were included in the midpoint to post intervention stage; school often close for 2 weeks at this time. Additionally, during the weeks at the end of term, there is an increase in non-academic activities such as school trips, sports days, celebration days and school plays which would further reduce the academic teaching time available for teachers.

These results support the findings of previous studies which resulted in improved literacy performance from children in mainstream schools using Headsprout (Twyman, Layng & Layng, 2011; Tyler, Hughes, Beverly & Hastings 2015; Watkins et al, 2016; Storey, McDowell & Leslie, 2019) and also the findings of the NRP, 2000 that systematic phonics approach is the most effective way of teaching literacy. Schools in the treatment group outperformed the schools in the control group in increases in SRA. This indicates that not only were the teaching as usual methods employed ineffective in helping to close the gap between disadvantaged and non-disadvantaged pupils, the gap is likely in effect to have increased during the 6 months of this study. There was no statistically significant difference between both the SRA and PRA scores at baseline between the treatment and control groups. Further statistical analysis showed that they were statistically significant differences in the increase in SRA and PRA between the 2 groups at post intervention. Although teaching as usual improved the literacy of pupils, it was not effective in closing the attainment gap between those performing at the expected level and those not; as lessons become more difficult, it is likely the attainment gap will increase (Goodman & Gregg, 2010). Previous research which has shown to be the case (DENI, 2015, 2019) is supported by the findings of this study.

The fact that the attainment gap increases over time would suggest effective programs, like HER, that exponentially close the attainment gap are vital during times of the school year when less teaching occurs. Pupils already struggling with literacy will be impacted more by less teaching time than those not struggling. Considering the accelerated impact HER had during this research on the trajectory of learning, HER could provide the instruction that teachers are not able to during times of limited teaching hours. Additionally, on occasions of school closure such as the event of the COVID-19 pandemic or when pupils are not able to physically attend school because of long term illness, HER may provide access to effective

online learning to help mitigate the absence of face to face teaching. HER is already being used by schools in such circumstances (Geiger & Dawson, 2020).

Considering this intervention took place over 6 months, the results of the PERA and FIT assessments are very encouraging. Evaluation of the results indicates that using a systematic phonics based approach to literacy instruction (NRP, 2000) with a strong evidence base to support its efficacy, resulted in much higher level of improvement in literacy performance than use of teaching as usual. Whereas use of Headsprout accelerated the improvements seen in the literacy performance of pupils, it could be argued the use of eclectic methods, resources and technology appeared to perpetuate the problem of the literacy attainment gap more than addressing it. In this instance Headsprout responded to the need for an effective intervention to quicken the pace of learning (Rose, 2009) in a way that teaching as usual didn't.

Limitations of this study were the fact that the SI was unable to obtain a clear picture of what teaching as usual involved. The curriculum, general guidance on literacy learning outcomes, and the process of intervention for pupils struggling with literacy from the N. Ireland education and library boards do not clearly outline which literacy teaching strategies and resources should be used. In practice, these vary from school to school, a limitation first identified by Storey, McDowell and Leslie (2019), who highlighted the difficulty in evaluating and comparing "teaching as usual" (a variety of methods and interventions) with HER, an evidence-based, sequenced and systematic intervention. More research is necessary in relation to identifying and evaluating exactly which strategies and teaching materials schools in N.I. use with at risk pupils. Additionally, despite the fact the duration of this study was 6 months, only 1 of the 5 schools in the treatment group was able to complete the entire HER program with the majority of its pupils. 4 episodes per week was the initial target however, as the research progressed the majority of school felt were unable to meet this target

because of demands on time and resources from the existing curriculum and timetable. Previous studies had often used external resources, such as research teams to run the HER program reducing the impact on teachers' time. However, limitations noted by these researchers (Storey, McDowell & Leslie 2017, 2019) were that, despite results that support the use of HER over other strategies, schools often fail to continue to offer the program once the research projects have been completed. This study required teachers to avail of training and then run the program and allocate time accordingly; this reduced the need for researchers to be present in the school. If time allowed, it would be interesting to follow up with schools to evaluate the longevity of the intervention. Future studies should aim to run HER in such a manner over an entire school year which would allow completion of the entire HER program at approximately 2 episodes per week which was the average episode completion rate during this study, and allow follow-up evaluation of the impact on pupils, and the use of HER within the school system.

Another limitation was the fact teachers were responsible for selection of pupils. This may have led to certain biases that impacted on pupil selection which resulted in certain pupils being excluded from parts of the study. Ideally, the SI and research team would be responsible for selection of pupils via more in-depth performance analysis than was available in this study. This would require more time at the pre intervention stage to carry such performance analysis and may also require prior pupil/parent/school approval to review school assessment result currently not available to the research team under General Protection Data Regulations. An extended study period would assist in this aim.

This study was successful in meeting the aim of evaluating the impact of HER on pupils' literacy in comparison to teaching as usual. Additionally, this study was successful in increasing the social and ecological validity required to sustain the program in the future, which is likely to foster a more pragmatic, acceptant attitude to the use of evidence-based

practice. Of the 5 schools in the treatment group, 4 schools continued to use HER in the school year following the conclusion of this study. Additionally, of the 3 schools in the control group, 2 were using their licences to begin the program for the first time while the third school was in the process of setting up a HER group when the COVID-19 school closures occurred. This study was successful in informing practice within these schools. It applied the learning of this and previous studies in the use of an effective, evidence-based approach to improving literacy performance with disadvantaged children which narrowed the attainment gap in a way teaching as usual was unable to do.

Future studies in this area should focus on increasing the sample size by testing the impact of HER nationally across a larger number of schools in N. Ireland. Additionally, further research into the knowledge and use of evidence-based practice in schools could allow educators to harness best practice in way that ultimately benefits the pupils who need help the most. This should be the ultimate aim of such educational research, identifying the educational resources such as HER, that make the most significant improvement to pupil performance in the most effective and efficient manner.

Chapter 3: Using schools to run Headsprout independently

3.1 Introduction

"The singing I like best is when I sing myself", Marty Rubin, author.

Children from disadvantaged backgrounds who are struggling with literacy are being left behind educationally. Existing research and statistics (Save the Children, 2016; DENI, 2015, 2019) indicates the teaching methods used to address poor literacy in disadvantaged children are not effective in closing the attainment gap between them and non-disadvantaged children. Yet they endure, because sufficient numbers of pupils meet educational attainment targets to maintain existing teaching methods in schools. Up to date and informed guidance from education authorities on evidenced backed, effective and efficient teaching methods to tackle literacy issues for such pupils is limited.

Count Read Strategy and EBP

Examination of the Count Read Strategy (CRS) (2011) designed specifically to target numeracy and literacy underachievement in those from poorer socio-economic backgrounds in N. Ireland, illustrates this point. When outlining interventions for disadvantaged pupils, the CRS suggests using existing in-school interventions. If a pupil is still under performing after several cycles of such support, the CRS suggest trying the intervention again. Additionally, there is a notable lack of the use of the term evidence-based practice (EBP) in the CRS guidelines. CRS promotes the sharing of best practice between schools despite the fact what works in one school, for some pupils, may not in another. There is limited guidance on how to modify current practice to suit individual learner's needs - the lynchpin of most EBP. This lack of appropriate guidance and leadership has encouraged a culture which is overly dependent on word of mouth and the perceived knowledge of individual teachers as to "what works" in education. Added to this lack of authoritative leadership and guidance on the use of EBP are inherent limitations to the effectiveness and availability of teacher training

(Galanouli, Murphy & Gardner, 2004; Haydn and Barton, 2007; BESA, 2014; BESA, 2019). During teacher training, for both new staff and via continuous professional development (CPD), the focus on learning how to identify EBP and the potential benefits to both teachers and pupils is clearly insufficient. The majority of teachers questioned by Department of Education in 2014 stated they were not confident in engaging with EBP research and did not feel able to judge its quality. School leadership and teachers will naturally follow government guidance; when the guidance is not well informed or based on current EBP, problems with closing the literacy gap will endure as reflected by the data from DENI (2015, 2019). This highlights one of the major issues facing education; a culture whereby perceived 'best practice' is based on anecdotal evidence, intuition and word of mouth as opposed to robust, evidence-based practice.

Education is not alone in facing this problem; medicine in the 1970s and 1980s faced similar challenges (Hargreaves, 1996). Doctors' work practices and decision making were often based on their accumulated personal expertise. Change only occurred when proponents of EBP, based on rigorous study, testing and replication were able to show more positive outcomes on human health. The overwhelming evidence, showing the benefits of reliance on scientific methods forced a change in culture from the top down, to one where EBP was and is seen as an intrinsic part of medical practice (Moayyeri & Soltani, 2005). An important goal of the introduction of EBP into medicine was the need to educate physicians. Strategies included ongoing training in the practice of evidence-based medicine, the continuous sharing of scientifically supported methods by specifically hired EBP professionals and performance feedback (Guyatt et al, 1992). Such a cultural change is required in education. Acceptance of existing educational methods and expected outcomes by authorities ensure these methods endure. Ultimately, the problem does not lie with teachers or indeed schools; they are guided via teacher training and CPD from government bodies such as local education and library

boards in N. Ireland. The problems lie with government policy makers and local educational leadership teams who are failing to inform school leaders of best practice that has been rigorously tested and meets the required standards of EBP.

Review and research

To move from the current situation whereby anecdotal evidence informs practice rather than knowledge of EBP, two areas should be given priority: an in depth evaluation and review of existing teaching methods and resources, and a large scale expansion of training into EBP practices in education, including school involvement in applied research. A comprehensive analysis of existing literacy teaching methods, which often involve an eclectic mix of techniques (Storey, McDowell & Leslie, 2017) would provide clarity on what approaches are currently in use. Attainment figures demonstrate that despite increasing literacy skills for Northern Irish pupils, these methods are not effective for all pupils. Teacher training should focus on training teachers in what evidence they should look for, in relation to data collection and analysis so that they can understand when an approach is effective, or not. The culture in schools, shaped by government guidance documentation, must change to one where evidence-based practice becomes a key factor in determining which educational approaches and interventions are used. In short, EBP needs to become part of the educational vernacular in the way it did and has endured in the field of medicine.

Changing this culture involves changing how school management behaves. One of the most effective factors in behaviour change is involving those whose behaviour you want to change in the design and implementation of the process (Farnham, Horton & White, 2003; Kelly, West & Dee, 2001). Improving pupil performance in literacy, should involve partnership between schools and research centres of excellence. Involvement in such rigorous, scientific research will allow schools to both identify suitable, affordable EBP available and understand

the resources and adaptations needed to teaching environments to allow such practice to thrive. This is a key part of applied research which should seek to ensure adoption and maintenance of interventions and practices. What works in theory may not work in practice without due attention to the environmental conditions required. Cuts in school funding which have impacted every aspect of the teaching environment since 2010, would suggest expecting schools to direct limited resources to become involved in research is unrealistic. However, existing budgetary pressures combined with the expected economic impact of the COVID-19 pandemic will require "more for less". Funding for education is unlikely to increase in the short/medium term (OECD, 2020) therefore the pressure on schools to maintain/improve pupil attainment should make EBP an intrinsic part of how they operate. Involvement in applied research is the key to informing schools on the best methods and techniques available and their capacity to cope and willingness to adapt to the demand of such EBP.

Austin (2016) suggests a research-based approach from teachers "should not be an optional extra but should be an essential and integrated dimension of effective professional practice; a learning based disposition is therefore crucial for teacher" (p10). Whereas research undertaken by outsiders to school can be difficult as they don't know the environment, Austin suggests research from within the school can be enhanced by situational knowledge and use of existing relationships. School leadership plays a crucial role in structuring and supporting such school based research, by building research into school improvement plans and having research as part of an ongoing school strategy. Effective research can make significant impact to school outcomes, teacher performance and ultimately, pupil learning. Additionally, the results of such research (simply defined by Stenhouse (1975) as - systematic enquiry made public) will extend and enhance professional practice beyond the walls of the individual school, and likely ensure the maintenance of effective programs beyond the limits of the research period. This social and ecological validity is a key aspect of research; ensuring the

use of effective approaches are maintained and adopted, rather than abandoned in favour of the newest or most popular approach, once the initial research has concluded.

Internal school resources

While there is a strong and growing evidence base showing the positive, accelerated impact that HER can make on pupils literacy performance (Pindiprolu & Forbush 2009; Huffstetter et al, 2010; Grindle et al, 2013; Twyman, Layng & Layng, 2011; Tyler, Hughes, Beverly & Hastings 2015; Storey, McDowell and Leslie, 2017, 2019), most of these studies have used external resources, i.e., researchers and/or computer hardware, to deliver Headsprout Early Reading (HER) within the school environment. This has been identified as a methodological limitation (Storey, McDowell and Leslie, 2017) as many of the schools involved failed to continue using HER when the research ended, despite positive pupil attainment results. The teaching environment became artificial through the use of external resources such as research teams, and, when these were no longer available, the existing environment was not able to support the implementation of the HER intervention. The social and ecological validity of an intervention program depends on such factors; and even successful interventions can be difficult to replicate with limited resources Various educational technology research (Richardson, 1997; Bayraktar, 2001; Camnalbur and Erdogan, 2008) have shown the importance of suitable teaching environments in the use of educational technology. Despite evidence demonstrating computer assisted educational technology (CAI) can improve educational performance, the mere presence of it is not be enough to improve pupil performance. Not all CAI is based on evidence-based instructional methodology. The introduction of CAI can also bring a concurrent pressure to restructure the school day to embed the program into the school environment and support teachers to use it effectively (Means, Olson & Ruskus, 1995; Roschelle, Pea, Hoadley, Gordin & Means, 2000). Accordingly, Michie, Atkin & West, (2014) identify three interacting factors that must be

present to produce behavioural change in schools. The psychological or physical capability of teachers, the environmental opportunity for the behaviour to occur and the motivation to activate or inhibit behaviour. When either of these factors is missing, it is extremely difficult for schools to adhere to the fidelity of a program (Lord et al., 2017).

Teacher workload

The question of the environmental opportunity and the attitude of teachers demands analysis of a primary school teacher's workload. Primary school teachers in the UK worked the most unpaid overtime of all public sector employees at a weekly average of 12.1 hours (OECD, 2014). In addition, over half of all teachers work unpaid overtime including working through lunchbreaks (Trade Union Congress, 2019). It is the responsibility of each school to ensure they meet the requirements of the national curriculum and ensure adequate time is spent on each subject as, according to the UK Education Act 2002, the time primary school teachers need to allocate to teaching each subject cannot be proscribed. In N. Ireland, a teacher's weekly work time is 32.4 hours, of which, an average of 21.5 hours is spent teaching curriculum subjects (OECD, 2015). Approximately 5 hours per week is allocated to teaching English (Department of Education, 2018) in average class sizes of 25 pupils, compared to the European Union (EU) average of 21. In addition to teaching, staff are required to make time for lesson planning, marking, general paperwork, communication with staff/parents/pupils, supervision, team dialogue and extracurricular activities (OECD, 2015). Additional pressures on teachers come from budget cuts, with the Chairman of the N. Ireland Affairs Committee at Westminster claiming in 2019 that the lack of funding is having a devastating effect on N. Ireland schools. Between 2011-2019, spending per head decreased, despite pupil numbers rising by 2.5%. Additionally, the fact that almost a quarter of all pupils with special needs are now educated in mainstream schools increases the demands on schoolteachers. Teachers have seen an increase in administrative duties and non-teaching requirements, increased

expectations of availability for extracurricular activities and specialist nonpaid roles, less teaching preparation time, more time spent on pastoral care, discipline and communication with individual students and a general increase in work intensity. These factors inhibit teacher's ability to undertake professional development training and to implement additional support for those pupils already struggling. As such, expecting teachers to effectively oversee the implementation of programs such as HER in addition to the existing curriculum, is a substantial ask from researchers. A primary school teacher supervising 4 HER session per week, at 30 minutes per episode, would be using approximately 9.3% of their weekly teaching time on HER (2hr out of 21.5hrs). Fulfilling this role requires training on the appropriate use of such technology and a suitable level of competency in ICT. As of 2015 only a third of ICT teachers in the UK held the required qualification to teach ICT (UK Parliament, 2019). This lack of I.T. knowledge and competency leads to a lack of confidence and a subsequent negative impact on level of use (Na, 1993; Francis-Pelton and Pelton, 1996; Al-Oteawi, 2002; Berner, 2003) as well as a fear of the increased time and energy commitment required for the implementation of CAI (Liu, Szabo, 2009).

School calendar

An additional obstacle to the researchers evaluating school-based interventions, is the pressure on the school calendar year. Primary schools in N. Ireland must be in operation for 200 days over three terms each school year. The number of days in each term differs; the 2019/20 school year entailed term 1 from September to Christmas (78 days), term 2 from Christmas to Easter (67 days) and term 3 from Easter to summer holiday (50). The actual number of teaching days can vary between 185-190 days with teacher training and school development days accounting for the rest (European Commission, 2020). This would indicate that as the school year progresses, time constrains become an increasing issue. A decrease in teaching days in term 3 combined with end of year social, non-curricular activities is likely to

result on schools focusing on existing methods teaching of the curriculum at the expense of other novel approaches such as HER. Research such as Besoluk & Onder, (2011), has suggested that academic performance peaks in term 2 often because term 1 can often involve a period of settling in while term 3 sees an increase in extracurricular activities.

Students participating in reading interventions improved more when receiving interventions several times per week (Cavanaugh, Kim & Vaughn, 2004; Needlman, Dreyer, Klass & Mendelsohn, 2005). Although Headsprout recommends completion of 3 episodes per week, some studies have often found this level of completion unattainable (Huffstetter, King, Onwuegbuzie, Schneider & Powell-Smith; K. A. 2010; Twyman, Layng & Layng 2011; Kreskey, 2012; Cullen et al, 2014; Roberts-Tyler, Hughes & Hastings, 2019). Limits to the number of episodes completed per week has often resulted on the impact of HER being based upon partial completion of the program. The challenge of having pupils complete a sufficient number of episodes HER is clear; how can teachers and pupils manage the suggested number of episodes per week in addition to the demands of the regular curriculum. Budget cuts, increases in the number of SEN pupils, larger class sizes and teacher frustration at lack of pay increases and poor availability and quality of training create a difficult environment in which to introduce “additional” demands on teachers.

Ultimately, the ability of schools to use CAI programs such as HER independently will determine the success of outcomes. This research evaluated the ability of school staff operating within the current environmental pressures in Northern Irish primary schools, to independently and consistently facilitate pupils to complete four episodes of HER per week, for the six month duration of the research. Furthermore, this study evaluated the number of episodes completed in each of the individual months of the intervention. The aim was to identify possible variances in available teaching time within the school year, helping to inform opinion on future research into the use of HER in mainstream schools.

3.2 Method

Participants

Participants were five N. Ireland primary schools who had pupils receiving the HER intervention from Jan-June 2019. Schools were included in this research if they:

iv. Agreed to complete four episodes per week for the 6 months duration of research.

v. Ensured completion and return of school and pupil consent forms.

vi. Demonstrated an ability to allocate existing resources to the research project in terms of computers and teacher time.

vii. Had a sufficient number of pupils eligible for FSM (greater than 29%)

Setting

HER sessions were carried out at the 5 mainstream primary schools identified in Chapter 2, p72 with pupils in the treatment group (see table 2.1). A target of 4 episodes per week, for 30 minutes per episode was established as an achievable standard, based on available time in the school year to facilitate program completion. HER sessions were carried out in various settings throughout the school, including computer suites, classrooms and corridors based on the available resources each day in each school. Pupils completed HER episodes on PC, Laptop or iPad. Each school HER coordinator was responsible for timetabling HER on a weekly basis and informing relevant staff of the days and times sessions were scheduled for pupils. The researcher was present at the first day of HER use in each school and then at various points throughout the research.

Materials

Pupils required access to either a Laptop, PC, iPad/Tablet with internet/Wi-Fi connection to access the HER program. Each participant also had access to headphones to allow clarity of the instructions provided by the program. The school HER coordinators were present while pupils used the program to help with any technical issues such as login problems, charging computers and providing access to headphones. Additionally, the HER coordinator was responsible for maintaining on task behaviour during HER sessions using verbal prompts. If noise and off task behaviour occurred, teachers were instructed to briefly intervene, and redirect, as they would in a normal class. HER coordinators were also advised to ensure that pupils using iPads for HER used the same one throughout the research to avoid incorrect login on different computers.

Procedure

This study aimed to assess the ability of schools to run HER at the rate of four episodes per week. Individual usage data was extracted from the HER program by the SI on a weekly basis for all pupils in the treatment group. To extract individual usage data from HER the SI carried out the following steps:

1. Logon to the school account and select the “Manage Students” tab.
2. Select the Roster tab.
3. Select the Reports tab and select individual pupil information.
4. Click on the desired weekly date range.
5. Highlight and copy all available data.
6. Copy and paste all available data to an Excel worksheet.
7. Remove unnecessary data leaving “time spent” as the remaining data field.
8. Tally total time per pupil via the “autosum” function on Excel

Once this data was extracted, the SI was able to monitor and tally weekly usage data for all participants in the treatment group. This data was emailed on a weekly basis to treatment group literacy coordinators HER coordinators to allow them to monitor progress of their own pupils via a weekly progress chart (example Figure 3.1) and a weekly individual time tracker (example Table 3.1).

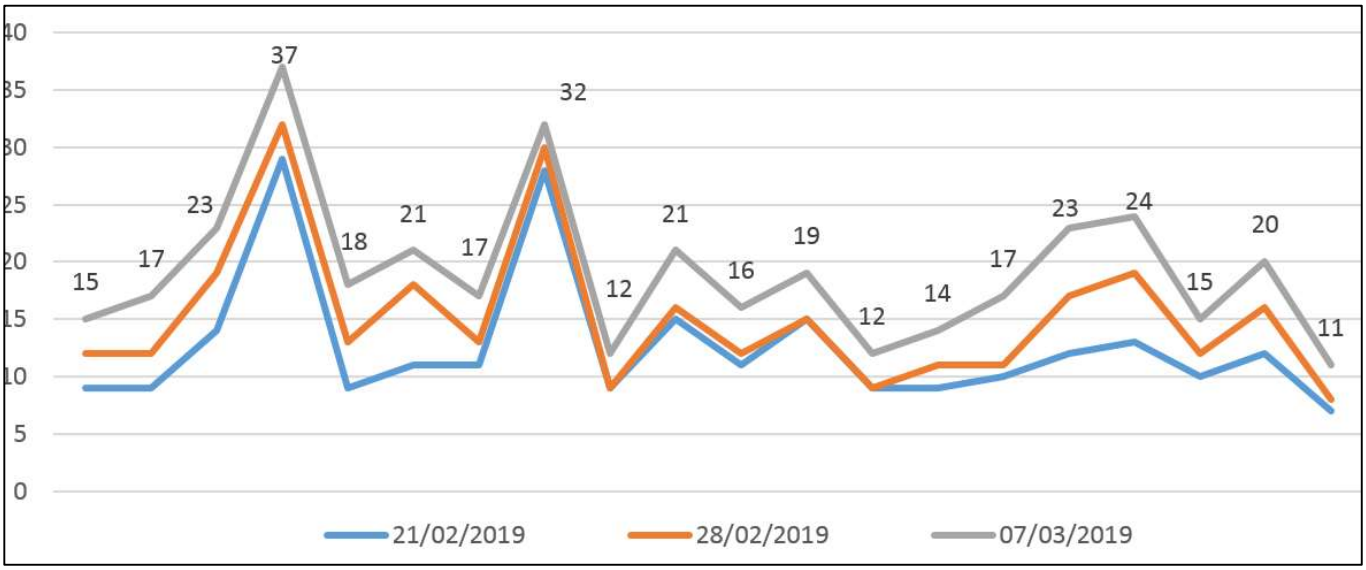

Figure 2.1 Sample weekly progress chart.

Table 3.1 Sample weekly pupil progress table.

Pupil ID	Week 1 mins on HER	Week 2 Time on HER	Week 3 Time on HER	Week 4 Time on HER	Week 5 Time on HER	Week 6 Time on HER	Week 7 Time on HER	Week 8 Time on HER
1	48	48	100	26	0	0	122	16
2	72	72	46	12	0	0	120	19
3	73	73	69	51	0	23	67	33
4	108	108	90	30	0	35	75	0

The SI contacted each school on a weekly basis to discuss progress and any issues that may have arisen. Initially, the SI visited schools on a weekly basis. After 4 weeks, this decreased

to fortnightly visits with weekly e-mail/phone contact maintained. At the end of the research, the SI tallied the total weekly/monthly time and end episode on HER for each pupil.

3.3 Results.

This aim of this study was to evaluate school's ability to implement HER, with light touch support from the SI. The data collected automatically by the HER program was used to evaluate several variables including how much time each pupil and school was able to spend on HER throughout the research, and how many episodes were completed by participants.

Table 3.2 Total & average time spent on HER and average final episode.

School	Total time on HER (minutes)	Average pupil time on HER (minutes)	Average weekly time on HER (minutes)	Average end episode	Average time per episode
1	21,642	1,352.63	56.36	39	34.68
2	39,103	2,300.18	95.84	77	29.87
3	19,382	1,490.90	62.12	55	27.10
4	21,254	1,416.90	59.04	45	31.48
5	17,444	969.11	40.38	31	31.26
Average	23,765	1,505.94	62.75	49.4	30.88

Table 3.2 shows the total and overall average time spent on HER by each school and the average final episode completed. The average total time spent on HER per school was 23,765 minutes. The average overall time spent per pupil on HER was 1505.94 minutes. The average final episode completed was episode 49. Of the 5 schools in the treatment group, school 2 had the highest mean completion rate per week, the highest weekly and overall time spent on HER per pupil, the highest number of episodes completed and the highest time spent per

week per pupil. School 5 had the had the lowest mean completion rate per week, the lowest weekly and overall time spent on HER per pupil, and pupils completed the lowest the lowest number of episodes.

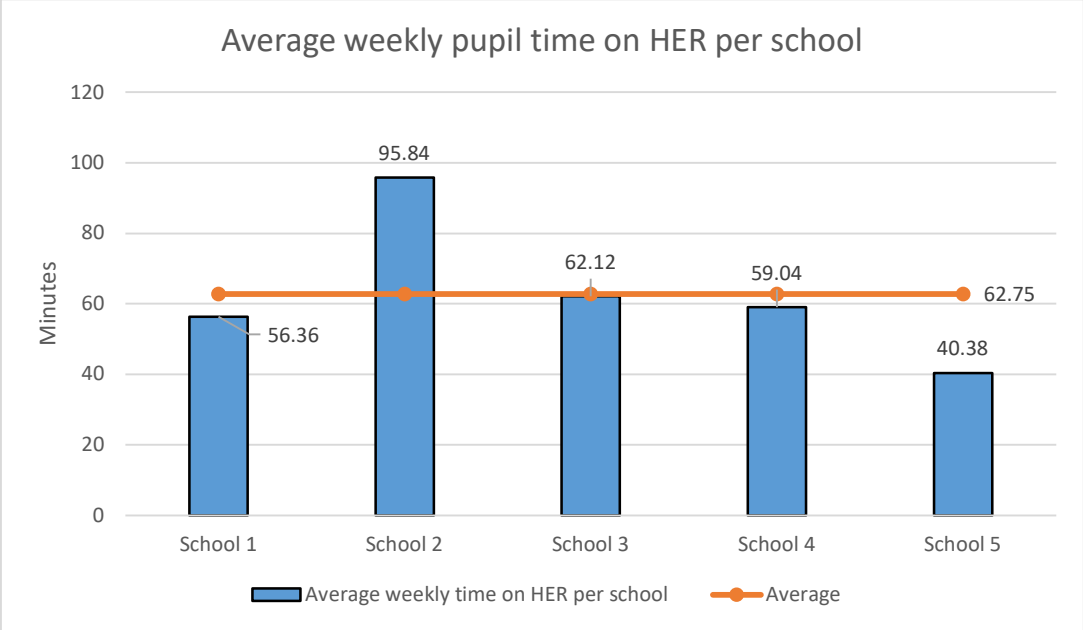

Figure 2.2 Average weekly pupil time on HER per school in minutes.

Figure 3.2 shows the average weekly time spent on HER was 62.65 minutes across the 5 schools. School 2 had the highest pupil weekly time at 95.84 minutes per week. School 3 had the second highest pupil weekly time at 62.12 minutes. School 4 had the third highest pupil weekly time at 59.04 minutes. School 1 had the fourth highest pupil weekly time at 56.36 minutes. School 5 had the lowest weekly time at an average of 40.38 minutes per week, per pupil. The average weekly pupil time using HER of 62.75 minutes.

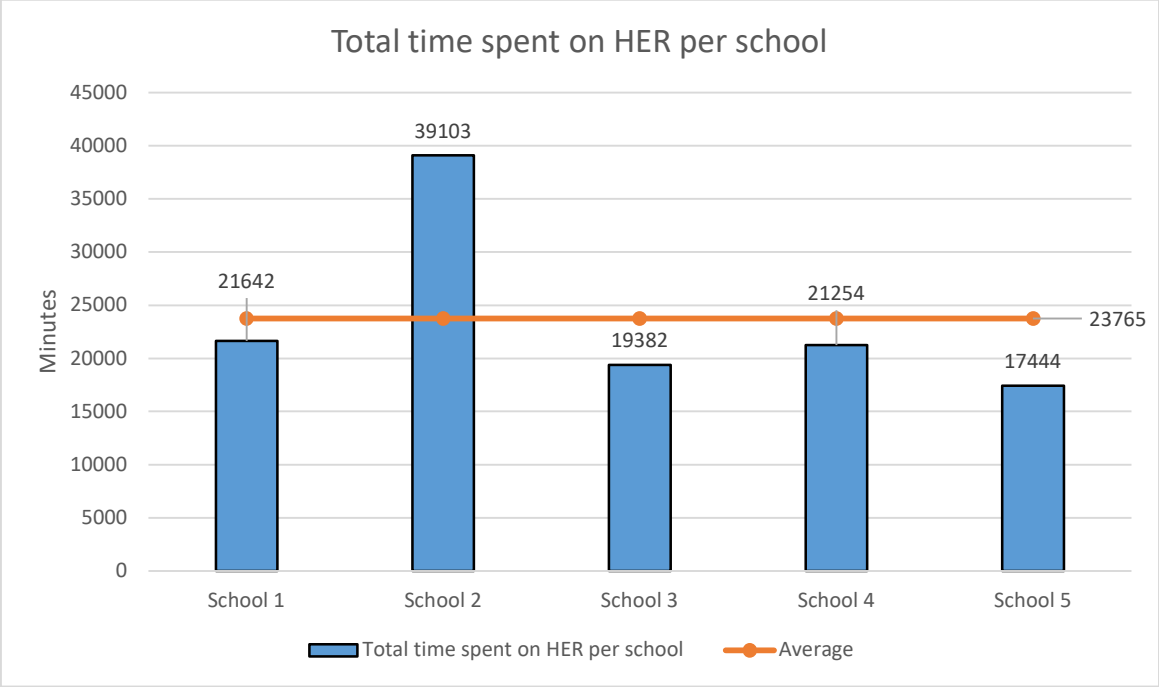

Figure 2.3 Total minutes per school spent on HER.

Figure 2.3 shows School 2 had the highest total time spent on HER at 39,103 minutes over the 24 weeks of the intervention. School 1 had the second highest total time on HER at 21,642 minutes. School 41 had the third highest total time on HER at 21,252 minutes. School 3 had the fourth highest total time on HER at 19,382 minutes. School 5 had the lowest total time at 17,444 minutes, 21,659 less than the highest school, school 2. The average total time spent across the 5 schools on HER was 23,765 minutes.

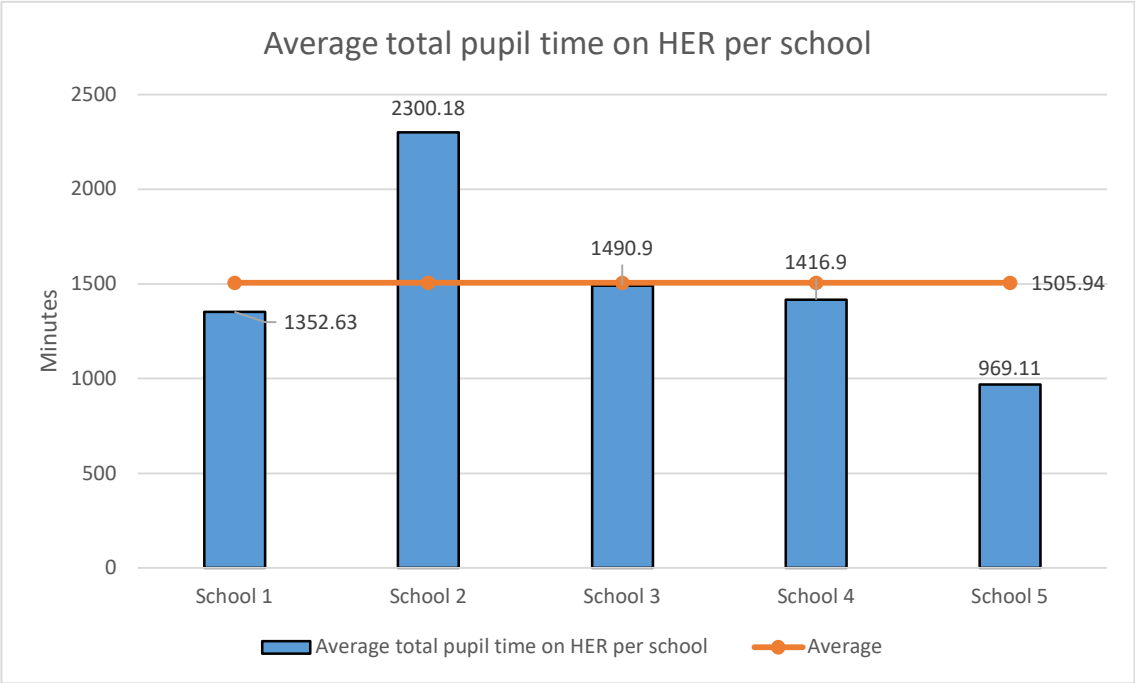

Figure 2.4 Pupil average minutes on HER per school

Figure 2.4 shows the average total pupil time spent on HER was 1505.94 minutes. School 2 had the highest average total pupil time at 2300.18 minutes. School 3 had the second highest average total pupil time at 2300.18 minutes. School 4 had the third highest average total pupil time at 1416.90 minutes. School 1 had the fourth highest average total pupil time at 1352.63 minutes. School 5 had the lowest average total pupil time at 969.11 minutes, a difference of 1331.07 minutes.

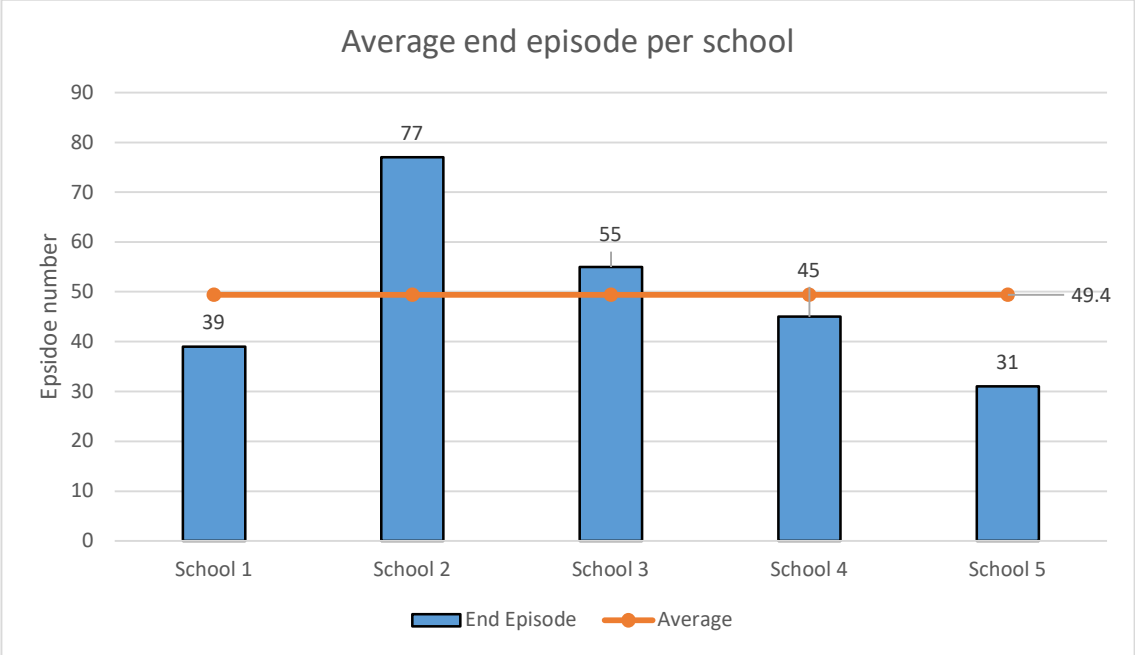

Figure 2.5 Average final episode completed per school.

Figure 2.5 shows the average final episode across the 5 schools was episode 49. School 2 had the highest end episode at 74. School 3 had the second highest end episode at 55. School 4 had the third highest end episode at 45. School 1 had the fourth highest end episode at 39. School 5 had the lowest at episode 35, a difference of 39 episodes between them and school 2.

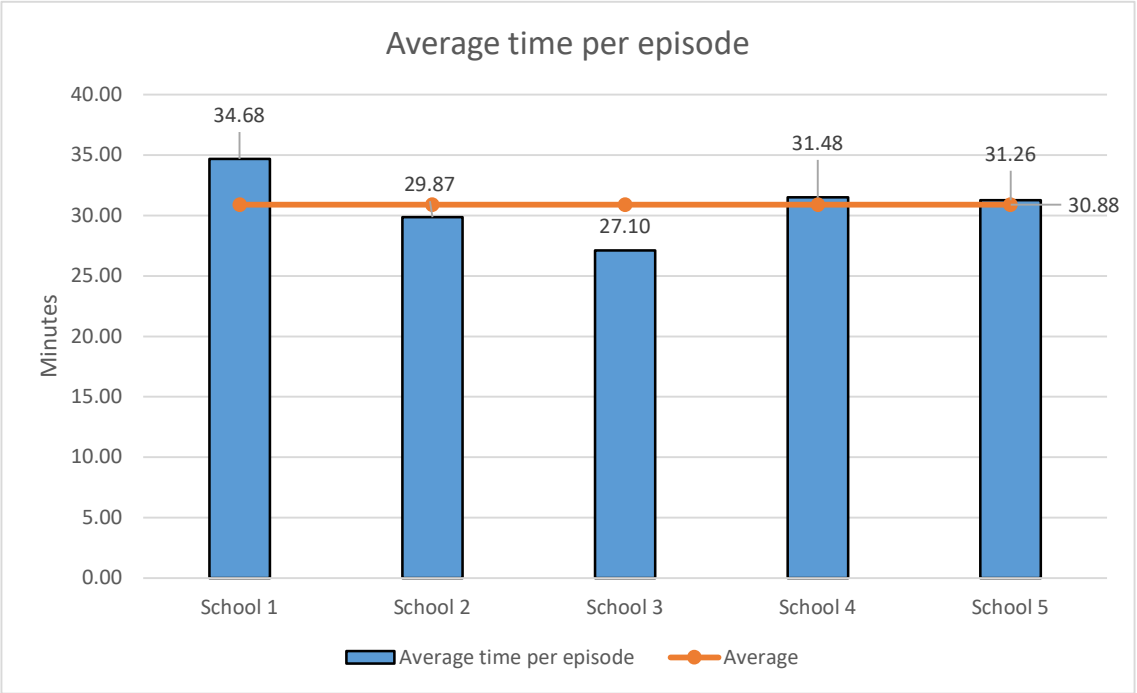

Figure 2.6 Average time per episode in minutes

Figure 2.6 shows the average time spent completing each episode was 30.88 minutes. School 1 spent an average of 34.68 minutes per episode, School 2 29.87 minutes, School 3, 27.10 minutes, School 4 31.48 minutes and School 5 31.26 minutes.

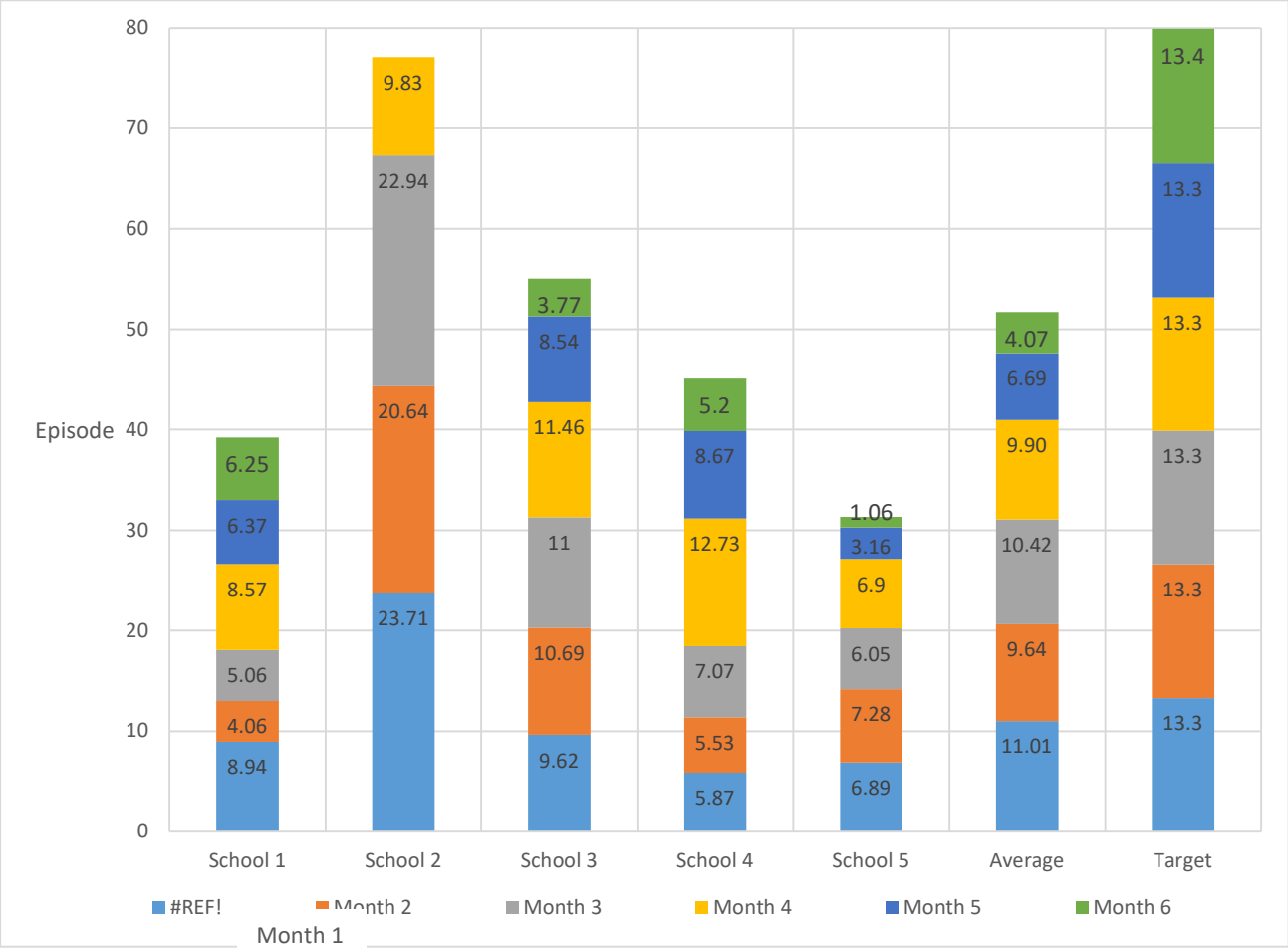

Figure 2.7 Monthly episode progress per school.

Figure 2.7 shows the monthly school progression through the HER program over the six months of the research. School 2 was the only school to exceed the target each month achieving full completion for all participants by the end of month 4. Monthly progress was 23.71; 44.35; 67.29; 77.12 (A pupil who was unable to complete the research accounts for this figure being less than 80). The average number of episodes completed per week varied from 1.3 in School 5 to 3.2 in School 2, with an overall average completion of approximately 2 episodes per week/8 episode per month.

Table 3.3 Sections of HER (1-4) completed by school and pupils.

School	Zero sections completed	Section 1 completed	Sections 1 & 2 completed	Section 1, 2 & 3 completed	Sections 1, 2, 3& 4 completed
1: 16 pupils	1	6	8	1	0
2: 17 pupils	0	0	1	7	9
3: 13 pupils	0	3	6	3	1
4: 15 pupils	0	0	7	7	1
5: 18 pupils	0	15	3	0	0
Total: 79	1	24	25	18	11

Table 3.3 shows the number of pupils in each school who were able to complete the different sections or zones of the HER program. School 2 had the highest number of pupils, (9/17), who completed the entire program, sections 1-4. It also had 7/17 pupil who completed sections 1-3. Schools 3 and 4 had only one pupil complete all sections (1- 4) of the program. Schools 1 and 5 didn't have any pupils who completed all 4 sections however, overall, 25/79 pupils were able to complete sections 1 & 2.

Table 3.4 HER episode completion by month for schools 1, 3, 4 & 5

	January	February	March	April	May	June	End Episode
School 1	9	5	5	11	4	5	39
School 2	22	23	21	11	N/A	N/A	77
School 3	9	11	11	11	9	4	55
School 4	6	5	7	13	8	6	45
School 5	7	7	6	7	0	4	31
Average	10.6	10.2	10	10.6	5.25	4.75	49.4

Table 3.4 show the variation in episode completion over the six months of the research. Schools consistently completed an average of 10 episodes per month for the first four months of the research. In the last two months, May and June, this dropped to an average of 4.75-5.25. It is worth noting that schools 2 had a much higher completion rate than all other schools. Figure 3.5 shows the completion rate with school 2 removed and shows a consistent completion rate varying from 7.75-10 for the first four months which then decreases to between 4.75-5.25 episodes for months 5 and 6.

Table 3.5 Episode completion rate for schools 1, 3, 4 & 5

	January	February	March	April	May	June	End Episode
School 1	9	5	5	11	4	5	39
School 3	9	11	11	11	9	4	55
School 4	6	5	7	13	8	6	45
School 5	7	7	6	7	0	4	31
Average	7.75	7	7.25	10.5	5.25	4.75	42.5

Table 3.6 HER use in school year after research period.

School	HER in use following research	Number of episodes per week	Comments
1	Yes	2	
2	Yes	3	
3	Yes	2	
4	Yes	2	
5	Yes	2	
6	Yes	3	
7	No	N/A	A new principal was to be appointed in September 2019. A decision on HER use would be made then.
8	Yes	2	

Table 3.6 shows that 7/8 (87.5%) of schools involved in the research project intended to use HER in the school year following the research at rate of approximately two episodes per week. School 7 was unable to commit to its use as the process of recruiting a new principal was ongoing and the new principal would be required to approve such decision. The SI informed staff in the school that he would be available to attend the school and discuss the

program with the new principal in December 2019. No contact was received as of the Covid-19 closure in March 2020. The SI intended to follow up with each school at the end of the school year to discuss progress however, the Covid-19 pandemic and subsequent school closures made this impossible.

3.4 Discussion

The aim of this study was to evaluate primary schools' ability to independently and consistently have pupils complete four HER episodes per week for the six months research period. Results indicate that only one of the five participating schools was able to reliably ensure pupils completed this number of episodes per week. On average, participating pupils completed only 2.06 episodes per week, with pupils spending an average of 30.88 minutes per episode. Schools were able to facilitate pupil's use of HER for approximately one hour per week in addition to their regular curriculum. The exception was school 2, where the majority of pupils were able to complete all 80 episodes of the program within the 24 weeks of the study. The average final episode completed of a possible 80, was episode 77. Those pupils who did not complete the entire program were unable to do so because of personal reasons.

The pupils in the four remaining treatment group schools averaged final episode 43. There were various reasons for the lower completion rates. School 1 reported issues in accessing available classroom space to complete HER. This often resulted in pupils working in corridors on iPads. When the SI discussed this with the school Principal, she stated as the pupils were working with headphones under specific 1-1 instruction, she didn't feel this had an adverse effect on pupils' completion of the program. However, the data extracted indicates that pupils in school 1 required the longest average episode completion time of all the schools at 34.68 minutes compared to an average of 30.88 minutes. A novel learning environment with an increase in possible distractions and noise can hinder concentration and ability to stay

on task (Slater, 1968; Dockrell, & Shield, 2006) and this may have been the case in school 1. Additionally, whereas pupils in the other schools always had a teacher or classroom assistant with them, pupils in school 1 were at times unsupervised as teachers moved between their classroom and the corridor to supervise other pupils. This may have increased off-task behaviour. A combination of these factors may have resulted in slower episode completion time in school 1.

The data indicates that school 2 outperformed all other schools in the treatment group in terms of episode completion. Two factors supported this performance level. The first is the impact of the HER coordinator appointed within this school. This person acted as a "champion" for the HER program by implementing a rigorous, systematic method of ensuring pupils completed the required number of episodes per week. Whereas other schools had pupils to complete HER at different times throughout the school day, based around existing timetables and available resources, in school 2 the HER program was timetabled specifically to be completed first thing in the morning before assembly. Additionally, if pupils had any spare time during the school day, they were directed to complete further HER episodes. In effect, HER became an integral part of the timetable for each participant, which resulted in the vast majority of pupils completing the entire program. The second important factor was how the School 2 leadership ensured the environment was prepared for the introduction of HER. A classroom assistant was provided to assist the teacher in running the program thus reducing the time pressure on that teacher. Furthermore, pupils used individually allocated iPads to work on HER for the duration of the program. In this school, HER was given high priority and resourced accordingly. The combination of the efforts of this teacher and school leadership resulted in school 2 having the highest weekly time spent on HER at 95.84 minutes (Average 62.75), the highest total time spent on HER 39,103

minutes (average 23,765), the highest average pupil time on HER 2300.18 minutes (average=1505.94).

School 2 also had the 2nd highest completion time per episode at 31.08 minutes (average= 29.28). This can be explained by the fact the later HER episodes become more challenging and take longer to complete. As the only school to have pupils reaching this level, completion time for school 2 may have slowed accordingly. However, it is important to note here that analysis of data in chapter 2 showed that pupils in School 2 had the highest increase in sentence reading age (SRA) and the 2nd highest increase in phonics reading age (PRA) of all pupils in the treatment group. In essence, the school leadership and teaching staff in school 2 manipulated the environment by restructuring the school timetable to embed the program into the school day. They provided sufficient resources in terms of hardware and teacher time to support teachers and pupils effectively. These are key requirements in the effective use of educational technology as identified by Michie, Atkin & West, (2014); Means, Olson & Ruskus, (1995); Roschelle, Pea, Hoadley, Gordin & Means, (2000). This effort resulted in school 2 outperforming other schools in episode completion at a rate of more than 2:1. It demonstrates the importance of preparing the environment, supporting teachers, and providing sufficient resources to ensure technology, particularly those with an evidence base of efficacy such as HER, is implemented as intended. In the other four schools, these environmental and staff contingencies were not embedded as effectively. Pupils appeared to complete HER on an adhoc basis, depending on available resources, on a variety of equipment (iPad, PCs and laptops) which changed from day to day. This resulted in pupils completing around half of the program, in comparison to school 2.

Teacher training and overall attitude to supplementary educational programs such as HER may have played an important role in school adherence to the implementation guidelines suggested by the research team. The attitude of the HER coordinator in school 2 towards the

use of HER and the culture of EBP was very positive. Having recently completed a Masters Degree in Teaching and Learning in which the benefits of EBP were prominent, this teacher was very passionate about the benefit of EBP. As previously discussed, the level of teacher training in EBP at initial training and subsequent professional development is inadequate. This may be why other schools in the treatment group were less rigorous about ensuring pupils completed 4 episodes each week. Changing the knowledge base through ongoing training around EBP, may be key to changing attitudes and culture within education. EBP and effective CAI programs must be seen for what they are, practice that have been proven, in suitable environments, to have high impact on pupil learning and one that must replace existing, ineffective methods. For example, literature has shown that school-based applications of the evidenced based ABA, indicate significant gains for pupils, across a range of measures in UK schools when compared with outcomes for pupils who received an eclectic approach; typically a combination of approaches where there is little or no scientific evidence supporting their use (Eldevik, Eikeseth, Jahr, & Smith, 2006; Foran et al., 2015; Grindle et al., 2013; Peters-Scheffer, 2010; Pitts et al., 2019). Yet UK schools are directed to favour this type of approach. Similarly, a study in schools in North America found despite recommendations, fewer than 10% of behavioural or educational strategies used with students were evidence-based (Hess, Morrier, Heflin, & Ivey, 2008).

Interestingly, no significant dose effect was identified by statistical analysis based on programme completion. HER is divided into 4 sections. Episodes 1-23 are called “Cracking the Code” in which pupils are required to master basic phonemic skills such as blending and segmenting. Episodes 24-40 “Making sense out of reading” increases reading vocabulary to 500 words by introducing basic sentences which increase in length and complexity. Episodes 40-80 target compound words (two word coming together e.g. sun-flower) and nonsense words (sorb, vight) as well as introducing aspects of reading comprehension. Although the

school that completed the most episodes had the highest increase in SRA, it wasn't statistically significant. Additionally, school 4 which had an average end episode of 45 (56% completion) had the highest increase in PRA (15 months), higher than school 2 (13 months) despite the fact school 2 had a much higher level of program completion (96%). In the FIT assessments, school 2 had the highest increase in correct answers and the highest decrease in incorrect answers. However, school 4 had an increase in correct answers that was 86.51% of school 2 despite only completing 56% of the program compared to 96% for school 2. Similarly, school 5 had the largest decrease in incorrect answers in the FIT assessments despite only completing 38% of the program with an end episode of 31. This may be explained by the fact the majority of the phonics training within HER occurs within the first 40 episodes. Episodes 40-80 introduce reading comprehension in combination with ongoing revision and practice of the phonics taught in the first 40 episodes. Once a pupil completes around 40 episodes, the majority of initial phonics learning had been achieved, as demonstrated by the assessment results of this research. As opposed to a dose effect, a school effect was identified. Pupils from school 2 were more likely to complete the program and attain higher scores in SRA, PRA and FIT than pupils in other schools in the treatment group. If the assessments within this study contained a comprehension element, it could be hypothesised that school 2 would outperform the other schools in this area as they were able to complete the later episodes of the program in which comprehension is taught.

Whereas the HER coordinator in School 2 organised pupils to complete episodes first thing in the morning, in other schools in the treatment group, the time when episodes were completed often changed on a daily basis. This was impacted by teacher and computer suite availability. If neither were available, HER was often moved to another day. This resulted in a consistent completion rate of episodes by School 2 and an inconsistent completion of episodes for the other treatment group schools as can be seen in Tables 3.4 & 3.5 on page 133. The number of

monthly episodes completed per school decreased dramatically in May and June. This reflects a decrease in teaching time that occurs at this time of year. The SI was not aware of this in advance of the research. Subsequent discussions with teachers and principals indicate that term 2, from Christmas to Easter, is considered the time of year when most teaching occurs. There is a drop off in teaching time in term 3, from Easter to summer with an increase in outdoor activities, school trips and sports days. This was reflected in this study where the average monthly number of episodes completed dropped from an average of approximately 10 in January to around 5 in May. The data from this study indicates that schools that begin HER in January will struggle to complete the program by the end of the school year unless it is included as part of the timetable. Using HER based on the availability of teachers and facilities resulted in inconsistent episode completion and partial program completion. Schools should begin use of the HER programme in September to allow appropriate time for completion. There are 39 term time weeks in UK primary schools. To complete HER during this time, 2.05 episode would be needed to be completed per week. 2.06 episode per week were competed as part of this study.

The issues of technical glitches within the HER program identified in advance by the SI were subsequently identified as a demotivating factor that may have influenced the level of completion by teachers. Teachers reported that HER froze for different pupils at different points in the program. This resulted in slower progress as certain pupils often had to repeat episodes. Teachers reported this caused a decrease in pupil motivation an increase in off task and distracting behaviour. To avoid duplication of episodes the SI had demonstrated to teachers how to manually progress a pupil from one episode to the next however, glitches were still an issue within the program and one that the HER developers should seek to address. HER tracks various data on pupil usage throughout the program. This data should be analysed to see at what points the program freezes with a view to identifying and

implementing fixes for problem episodes within the program. As discussed, teachers face difficult time pressures; expecting them to report technical issues is unrealistic. Monitoring and improvements in program performance should be the responsibility of the HER developers. Along with issues within the HER program, a combination of a weak Wi-Fi signal, unsuitable hardware, and the number of users online at the same time may have impacted on the ability of the school to run HER. Ensuring schools have suitable technology and facilities to allow them to harness the best evidence-based practice should be a key consideration of policy makers.

The question of sustainability was a key part of this research; did the fact schools ran HER independently foster a climate in which the program would be used again? When contacted by the SI at the beginning of the school year following this research, seven of the eight schools involved in this research indicated that they intended to setup new HER classes for the 2019/2020 school year. One school in the control group who hadn't decided if they would run HER were waiting on the appointment of a new principal before making a decision. It appears that allowing schools to run HER independently developed a social and ecological validity helping to ensure the intervention was maintained beyond the period of research. Considering the positive impact HER had on the literacy of disadvantaged children and its ability to exponentially close the literacy gap, this has been an important aspect of this research. Storey, McDowell & Leslie, (2017), highlighted the limitations of using an external research team to run HER. Although HER had a positive impact on literacy, the programme didn't endure beyond the research. This study built on this learning and supports the finding of Watkins et al. (2016) that use of schools to run HER, develops the skills, knowledge and a desire to sustain use of the program when the research period has ended. Future research should build on this by continuing to have schools run HER and other educational interventions, independently. Ultimately, the effectiveness of an educational intervention may

be tempered by the ability of a school to deliver it, and research should continue to focus on what attitudes, knowledge, systems and supports need to be in place to allow this to occur.

Chapter 4: A qualitative study of teachers attitudes to using Headsprout in primary schools.

4.1 Introduction

"Technology is just a tool. In terms of getting the kids working together and motivating them, the teacher is most important" Bill Gates, CEO Microsoft.

Educational technology can only be truly effective if the conditions to facilitate effective implementation within schools are met. Often, it is the lack of such conditions that limit educational technology's effectiveness. Teachers, as the professionals responsible for facilitating the implementation and use of technology, are often best placed to identify how suitable the environment is to enable its effective implementation. Ely, (1999) identified a framework of eight factors that must be in place for the effective implementation of innovative educational technology: Dissatisfaction with the status quo and a desire to change and improve; existence of knowledge and skills to use technology; availability of resources such as hardware, software and appropriate funding; availability of "good" time (paid, school time) to learn the necessary knowledge and skills for implementation; the existence of rewards or incentives to complete the required work; participation, shared decision making and widespread communication; commitment and endorsement from school leaders such as principals and board of governors; effective leadership at project implementation level.

Surveys: Perception of ICT

It is clear that teachers are at the centre of this framework; their attitude, expertise, commitment, and the level of support they receive are key aspects that enable effective implementation of strategies and resources. However, evaluating teachers' opinions about each of these aspects and whether they feel they have been supported is, as Ely suggests, crucial. This information enables decision makers and school leadership to learn and improve systems, based upon the experiences of the people who are the most "hands-on" educators. Large scale surveys such as the Teaching and Learning International Survey (TALIS), are

designed to obtain relevant feedback from teachers with a view influencing key policy decisions. However, smaller local level surveys and questionnaires can also play an important role in helping to shape an appropriate culture for continuous improvement and removing fear that exists regarding the use of technology in education (Austin, 2016).

Feedback from previous questionnaires examining the implementation of educational technology (Education Trust, 2010; Livingstone, 2011; Galanouli, Murphy & Gardner, 2014; Bingmlas, 2009; Trade Union Congress, 2019) identified the following areas of concern: school equipment, when available, is often unsuitable for use with new technology, pupils often had limited access because of competing needs; teachers are rarely given adequate time to learn and prepare for the use of new technology; ongoing technical problems and lack of ICT support reduce motivation to use educational technology for both pupils and teachers; a general scepticism on the actual efficacy of educational technology based on previous teacher experience exists. The quality of both ICT hardware and the level of training, will influence teachers' opinions and commitment to the implementation of new technology. Research into the effectiveness of ICT training has revealed a low uptake in teacher use of ICT, due to a lack of confidence resulting from generic industrial training, rather than subject specific ICT training (Haydn, 2008; Hadyn and Barton, 2007; Oldfield, 2010). Respondents also highlighted the need for high quality ICT training to support change and impact in the classroom (Davis Preston & Sahin, 2009). Responses also revealed perceptions of ICT increasing teachers workload, time limitations restricting the use of ICT (Bingimlas, 2009), variable access to appropriate hardware, ongoing technical problems and lack of ICT support further reduce motivation to use ICT (Korte & Husing, 2007).

Clearly, the perception of ICT among teachers is not as positive as the early proponents of computer use in school would have imagined. A report by BESA (2019) found that teacher unwillingness to engage with ICT was the biggest obstacle to uptake and use of ICT in

primary schools. The authors cited a lack of training and a perception that technology could replace teachers, as the main reasons behind a reluctance to use ICT. Identifying and supporting teachers to be the key conduit for the effective implementation of educational technology requires effective, specific training to ensure the required level of confidence and competence in the use of technology. ICT training is provided in initial teacher training and subsequently as part of their CPD. The skills developed in ICT training are intended to allow teachers to reach a level of competence in use of technology that enables their effective application in a teaching environment. Additionally, school computer hardware must be suitable to allow schools to test and harness effective technology. Appropriate preparation and learning time must be provided to ensure teachers' confidence and competence. Furthermore, suitable preparation time is required to prepare the learning environment for the implementation of novel learning resources such as HER. However, in an environment where 70% of primary school teachers believe their workload is a very serious problem (TALIS, 2018) and 67% have no prior qualification in ICT or have not been on an ICT course within the last 3 years (BESA, 2014), the introduction and implementation of new learning resources can be challenging. The fact that there is unwillingness from teachers to engage with ICT along with the proportion of schools believing they are well equipped with ICT dropping to its lowest point since 2012 (BESA, 2019), account for such challenges.

ICT training

ICT training should be subject specific as opposed to much of the generic industrial training that exists as poor quality training often leads to a lack of confidence and avoidance in the use of ICT (Haydn, 2006; Hadyn and Barton, 2007; Oldfield, 2010). Empowering teachers to have the competence and the confidence to utilise up to date, evidence-based practice requires ongoing professional development training; this is an area of education that has been impacted by the decade of austerity and budget cuts faced by schools. Professional

development is important as it develops key skills such as ICT but should also provide teachers with the knowledge differentiate between technology and technology that works, with an evidence base of effectiveness; especially when teaching phonics. As discussed previously, there is a large availability and wide variance in the quality and evidence base of ICT phonics based programs.

Teaching Phonics

Schools in N. Ireland are not under the same obligation to teaching phonics in the way their counterparts in the rest of the UK are. This has led to the use of varied eclectic approaches for children requiring additional literacy support. This often differs from school to school and use various resources, techniques and a combination of phonics and whole language approaches (Storey, McDowell & Leslie, 2020). It is therefore very difficult to identify which aspect of literacy teaching, if any, has had the most impact on children's learning. The plethora of supplementary online literacy programs available for use in primary schools, many of which lack any grounding in science or evidence-based practice, has led to an environment in which online educational resources are often seen as fads or gimmicks regardless of their evidence base (Stanovic, 2003). Teachers may therefore view online educational resources with suspicion. This is understandable when you consider how teacher training lacks depth and serious analysis of evidence-based practice and a focus on the development of a high level of ICT skills. It is hardly surprising that such attitudes and sceptical opinions towards systematic, school wide adoption and evaluation endure.

School funding

The decrease in funding available to N. Ireland schools since 2009 has resulted in a decrease in available funds for ICT equipment. Schools have faced difficult choices between maintaining staffing levels, classroom maintenance, upgrades of computer hardware,

transport services and the purchase of educational resources. In 2020, increased funding of £421 million has been sought from the Stormont executive to fund teacher pay agreements. This is in addition to the existing budget of £2billion per year to pay for SEN funding and essential maintenance work in schools that has been postponed due to previous budgetary pressures. However, rather than free up more money for additional resources, this is intended to backfill funding cuts experienced during the decade of austerity. This is likely to continue to force school leaders to choose between competing demands for limited funds.

Reading for pleasure

The enjoyment of reading and the confidence to so are vital aspects of developing literacy skills (Baker, Dreher & Guthrie, 2000; Cox & Guthrie 2001). However, enjoyment of reading is not a prevalent in children from poorer backgrounds (Neuman and Celano, 2001). Developing an intrinsic confidence is often a precursor to public confidence in reading. Previous attempts to increase the enjoyment of reading such as the 1998 National Reading Strategy's daily literacy hour suffered from lack of pupil engagement and enjoyment (Fisher, 2002). Sainsbury and Schagen, (2004), found that enjoyment of reading had declined in the six years since the introduction of the literacy hour. HER uses animations, game based learning, verbal prompts and coaching, and in lesson reinforcement, as well as a token economy, throughout episodes. These are all evidenced based teaching strategies that have been shown through decades of behavioural research to shape and maintain target behaviours. In HER, they are skilfully utilised to teach new skills in reading, but also build pupils enjoyment of and confidence in reading. Previous HER research has shown a positive level of enjoyment from typically developed participants, and participants with Autism Spectrum Disorder and intellectual disabilities (Freeman, 2015; Sullivan, Grindle and Hughes, 2017; Plavnick, Thompson, Englert, Mariage & Johnson, K. (2016). However, Storey, McDowell and Leslie, (2017) identified a methodological limitation of studies that use external staff to

research the effectiveness HER. They reported that schools are less likely to use HER when the research team's work ends as the expertise and experience of running the program lies with the research team as opposed to school staff.

Teacher time

Pressure on teacher time is a much discussed topic. Of a UK teachers normal work week of 32.4 hours, 5 hours is spent teaching English (Department of Education, 2018). The expectation to facilitate 4 HER episodes per week would take approximately two hours teaching time. The fact that UK primary school teachers work an average of 12.1 hours unpaid overtime per week (OECD, 2014) suggest that although 4 episodes per week was the aspiration, the reality would be different. Although the data from Chapter 2, Study 1 would provide the exact number of episodes completed weekly, the SI was aware that this may have been a larger number than is realistic as school made a big effort for the purposes of the research. It was important to listen to those teachers involved in running HER on what number of episodes per week was viable based on existing resources. UK primary schools are tasked with ensuring pupils are taught the contents of the national curriculum while ensuring adequate time is spent teaching each subject. In N. Ireland, a teacher's weekly work time is 32.4 hours per week of which, an average of 21.5 hours is spent teaching curriculum subjects (OECD, 2015) in an average class size of 25 compared to the European Union (EU) average of 21. In addition to teaching, staff are required to make time for lesson planning, marking, general paperwork, communication with staff/parents/pupils, supervision, team dialogue and extracurricular activities (OECD, 2015).

Technical glitches

One area of concern with the HER program was the frequency of technical glitches which cause it to freeze and crash. A cursory examination of online reviews sites such as

Appgroves.com highlights the problem. Despite HER receiving an overall positive rating of 3.8/5, many reviews cited their frustration with technical glitches within the program causing it to lag, freeze and crash. When this happens, the user is required to restart an episode. This can lead to frustration and a detrimental impact on motivation and progress for both the user and teacher. The SI identified the same technical problems as those highlighted online review sites in advance of the research. Schools were therefore advised to use iPads where possible. However, the number of iPads varied from school to school. As seen in Study1, chapter 2, schools who were able to use iPads for the duration of the research, were able to logon quicker and complete more episodes than those using Laptops/PCs.

This study utilised a short questionnaire to probe keys areas that were highlighted in previous studies and in conversations with school staff. These included: the difficulty in running the HER program in addition to the requirements of the curriculum, the viable number of episodes per week, the impact of the quality of school hardware, problems with glitches on the HER program, the perceived impact on pupil literacy and reading confidence, and the ability of the school to run the program independently. The aim was to collect information that would supplement the data obtained on pupil performance from Study 1 (Chapter 2) and school HER completion rates from Study 2 (Chapter 3) to provide a picture of the reality of running the HER program in N. Ireland primary schools, in an attempt to inform both future research and educational leadership.

4.2 Method

Participants

Participants (n = 9) were teaching staff in N. Ireland primary schools working directly with pupils in the treatment (intervention) group presented in chapter 2 (page 70). Inclusion criteria were: (1) teachers must have been employed by a participating primary school as a teacher or classroom assistant throughout the study; (2) teachers must have been directly involved in using HER with pupils on either a group or 1-1 basis for a minimum of 1 month.

Setting

This study was carried out in the five primary schools in N. Ireland who were involved in the HER study in chapter 2 (page 70).

Materials and measures

A questionnaire (Appendix 6) was designed to research the feasibility of using HER in primary schools based on the following key topics:

- Teacher perception of HER's impact on literacy.
- The perceived pupil enjoyment of HER.
- The ability to complete 3/4 episodes of Headsprout per week.
- The impact of technology on using HER in school.
- The perceived impact of external supports to run HER in schools.
- The potential benefits of teaching HER as part of the curriculum.
- The feasible number of HER episodes per week.

The questionnaire comprised 12 items. Questions 1-10 used a rating scale ranging from 1-10. Each end of the scale clearly labelled with unambiguous words to ensure clarity and understanding. The language used in the questionnaire was designed to be easily understood

and overly technical or leading language was avoided. Each question was designed to elicit a response from the respondent on one specific aspect of running HER in their school. Each answer section also allowed the respondent to explain the rationale for their response. The responses to the questionnaire were analysed by tallying the answers and analysing the comments to each question with a view to identifying common themes.

The questionnaire was e-mailed to the HER coordinator in each school. They were asked to distribute a copy to any relevant member of staff who met the inclusion criteria. The cover sheet of the questionnaire contained instructions on completion and informed respondents that their identity and answers would be anonymised. 9 questionnaires were distributed, 9 were completed and returned by post to the research team.

The number of respondents from each school were as follows:

School	Number of respondents
School 1	1
School 2	2
School 3	2
School 4	3
School 5	1

Procedure

In advance of sending the questionnaire, the SI contacted the principal of each school to inform them that questionnaires would be sent within 1 week. Principals were asked to ensure that all questionnaire were completed and to allocate time for staff to do so. Each literacy coordinator was subsequently emailed a copy of the questionnaire with details of how to complete contained within. Literacy coordinators were asked to print a copy for themselves

and one for any other members of staff who supported pupils to work on HER throughout the project. Participants were asked to handwrite their answers in pen and, when completed, return to the SI by post directly at Ulster University. 10 days after postal, a follow up phone call was made to school contacts who had not yet returned the completed questionnaires.

4.4 Results

Item 1 in the questionnaire asked teachers to rate the difficulty in having pupils complete 3-4 episodes a week. The scale on item 1 ranged from 1 = extremely easy to 10 = extremely difficult. Figure 3.1 shows the responses by school. The Average rating across all 9 participants was 5.92. In schools two, three and four, more than one staff member responded therefore an average score for those schools were used.

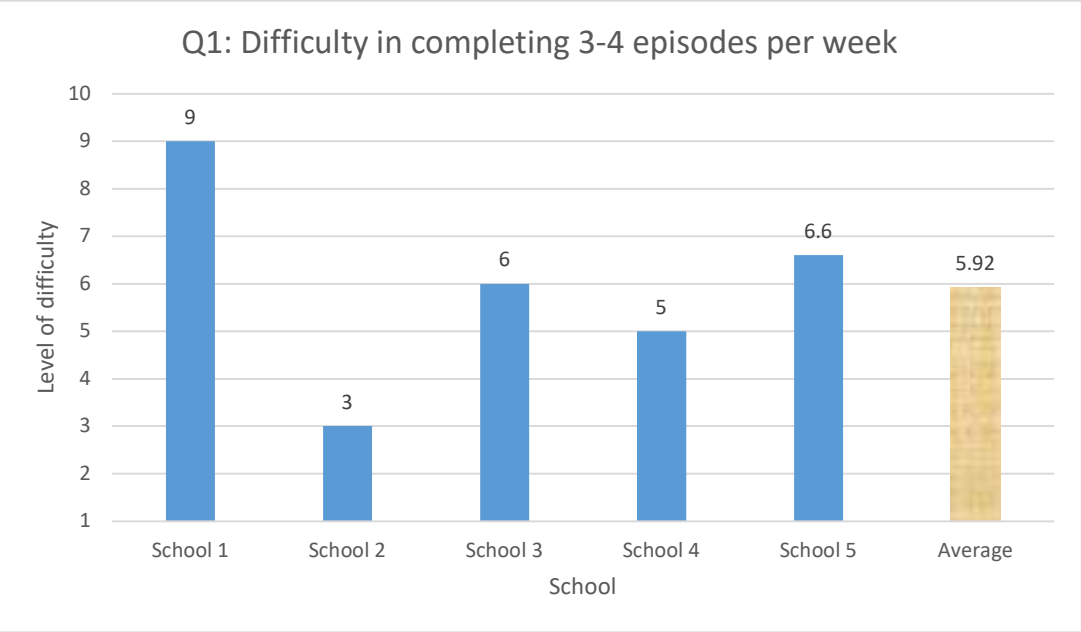

Figure 3.1 Q1: How easy/difficult was it to have pupils complete 3/4 episodes of Headsprout per week?

School 1 scored the difficulty of completing 3-4 episodes per week at 9 commenting that 4 episodes a week was a lot to expect when the rest of the curriculum had to be taught-this took priority.

School 2 scored the difficulty of completing 3-4 episodes per week at 3 commenting that some pupils tired of completing 4 episodes per week.

School 3 scored the difficulty of completing 3-4 episodes per week at 6. They commented limitations on available PCs within school because of competing needs of other subjects were an issue.

School 4 scored the difficulty of completing 3-4 episodes per week at 5 commenting that HER had to be scheduled in between events and the school curriculum. Although an additional staff member was trained to help run HER, the school timetable took priority therefore sometimes pupils missed completing episodes because of other commitments.

School 5 scored this question 6.6 difficulty. A lack of access to enough PCs and limited teacher time were issues with trying to complete 4 episodes per week.

Item 2 asked teachers to rate the impact that better school technology would have had on school's ability to run four HER episodes per week. The scale on item 2 ranged from 1 = no difference to 10 = major difference. Figure 3.2 shows the responses by schools. The average rating across all participants was 6.52.

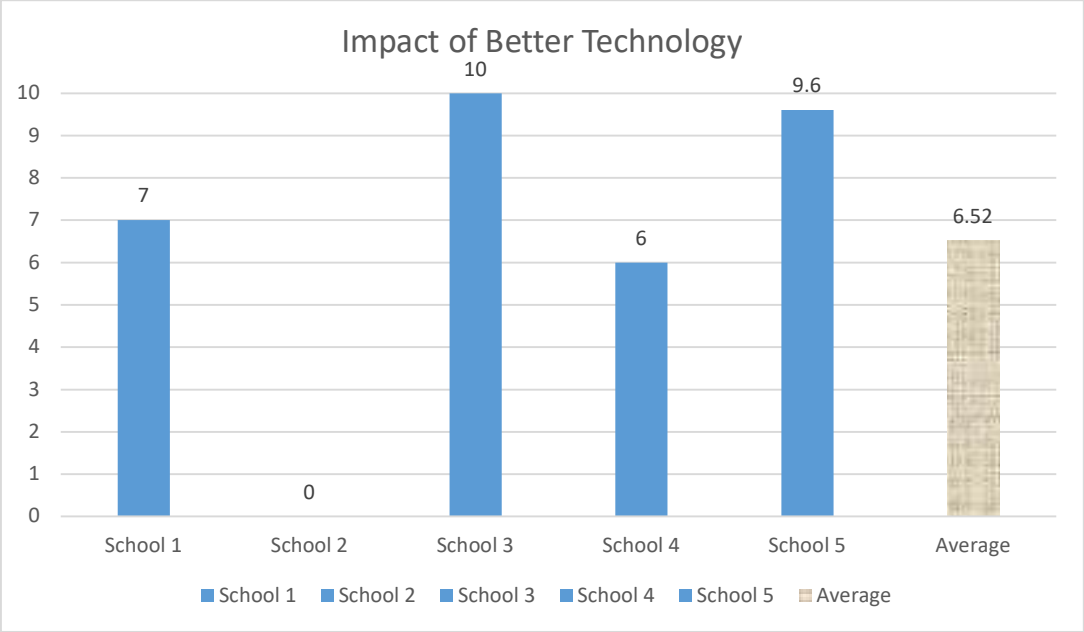

Figure 3.2 Q2: What difference would better technology have made to the ability to use Headsprout 3/4 times per week.

School 1 scored the difference improved technology in school would have made to the running of HER at 7/10, commenting better technology would certainly would have helped but fitting it into school time was the biggest challenge.

School 2 scored the difference improved technology in school would have made to the running of HER at 0/10. They commented that their school hardware was able to manage HER without any issues.

School 3 scored the difference improved technology in school would have made to the running of HER at 10 /10 difficulty. More computers would have made a huge difference in the school's ability to use HER.

School 4 scored the difference improved technology in school would have made to the running of HER at 6/10 difficulty commenting that us of iPads was vital as laptops were far too slow to boot up and load the program.

School 5 scored the difference improved technology in school would have made to the running of HER at 9.6/10 difficulty. They commented that having individual PCs or iPads for use during the project would have made it a lot easier to run.

Item 3 asked teachers to rate the impact that the use of an external support person to run Headsprout with pupils would have made to how many episodes pupils completed. The scale on item 3 ranged from 1 = no difference to 10 = major difference. Figure 3.3 shows the responses by schools. The average rating across all participants was 5.86.

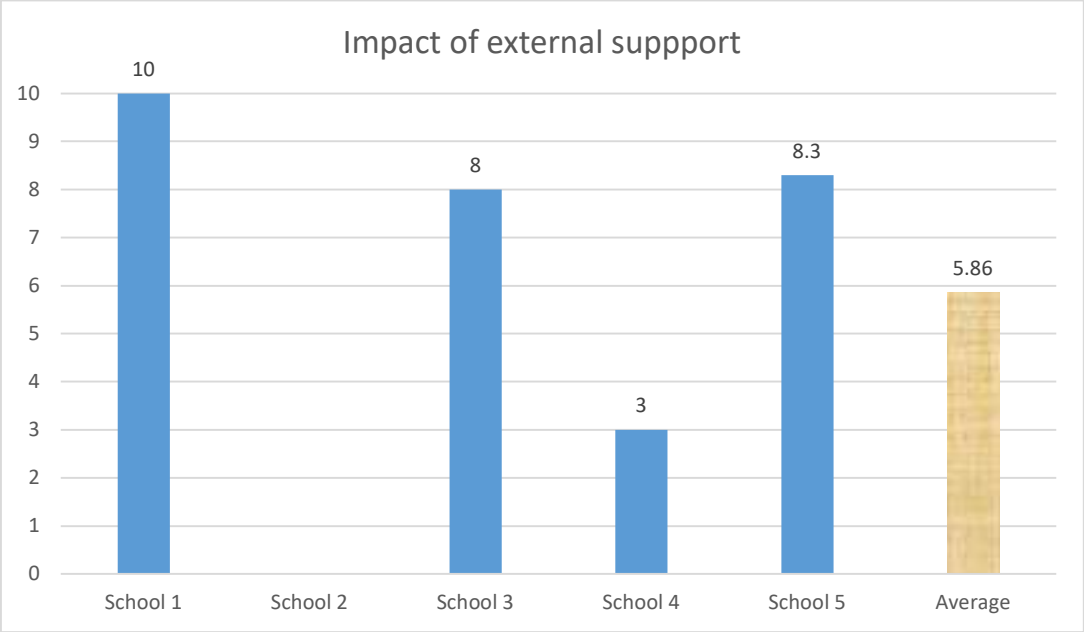

Figure 3.3 Q3: What difference would use of an external support person to run Headsprout with your pupils have made to how many episodes pupils completed?

School 1 scored the potential benefits of external support to run HER at 10. They commented this would have made an “enormous difference” to running HER as existing resources are so stretched.

School 2 scored the potential benefits of external support to run HER at 0 for. They commented that their school was able to operate HER with existing resources.

School 3 scored the potential benefits of external support to run HER at 8 difficulty. They commented it would have meant we could have ensured all the children were swiftly logged on and fully focused.

School 4 scored the potential benefits of external support to run HER at 3 difficulty commenting an external person would have been difficult to facilitate because of the schools busy, evolving timetable.

School 5 scored the potential benefits of external support to run HER at 8.3. They commented it would have helped with consistent use of HER in time pressured environments when teachers had other more pressing commitments.

Item 4 asked teachers to rate the difference it would make to schools' ability to run HER if it was included as part of the whole school curriculum rather than in addition to it. The scale on item 4 ranged from 1 = no difference to 10 = major difference. Figure 3.4 shows the responses by schools. The average rating across all participants was 5.4.

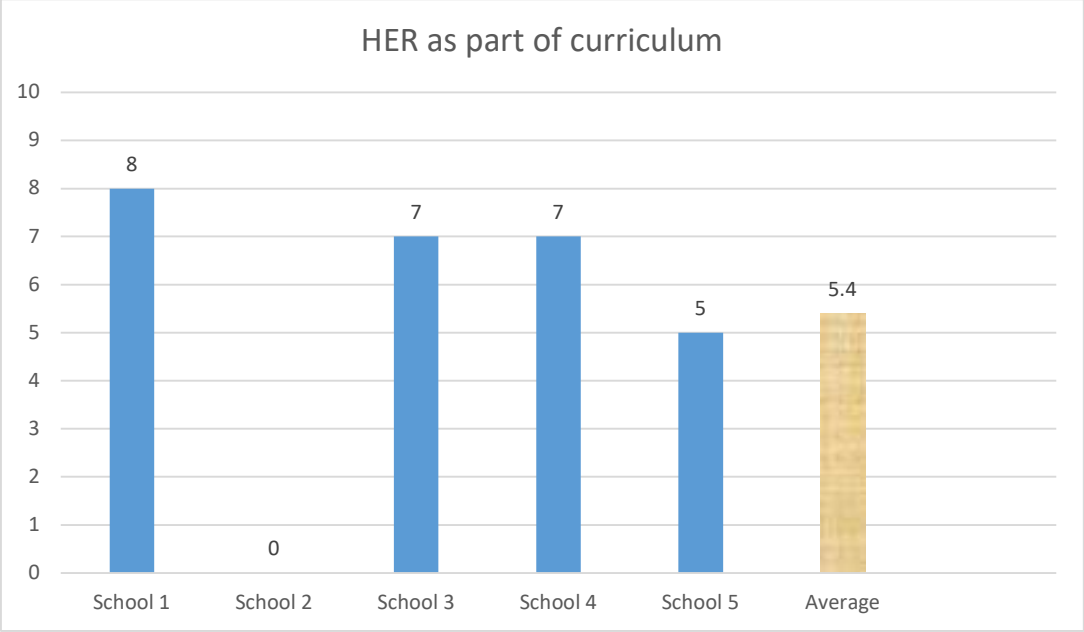

Figure 3.4 Q4: Would it have made a difference if Headsprout was completed as part of the whole class curriculum as opposed to in addition to it?

School 1 scored the difference having HER as part of the curriculum at 8 commenting that although it would be beneficial, more users would have impacted on the internet speed within the school which would have a negative impact on how well it worked.

School 2 scored the possible difference made if HER was part of the curriculum at 0. They commented that their internet would not have supported many more users at any 1 time. They were able to run the program in addition to the curriculum with careful planning.

School 3 scored the possible difference made if HER was part of the curriculum at 7. They commented although it would have made a difference, they felt HER isn't appropriate for all pupils, more those who are struggling with literacy.

School 4 scored the possible difference made if HER was part of the curriculum at 7 /10. They commented if it was part of the curriculum staff would have bought into it a bit more rather than seeing it as just another additional thing to do. More resources would be applied to it if it was part of the curriculum as it would have been seen a "must do" than rather than a "might do" area.

School 5 scored the possible difference made if HER was part of the curriculum at 5/10. They commented there are already sufficient programs in place to meet the requirement of the curriculum, another one would be difficult to operate with existing resources.

Item 5 asked teachers to suggest the viable number of HER episodes that the school could complete. Figure 3.5 shows the responses by schools. The average number of episodes was 2.6 per week.

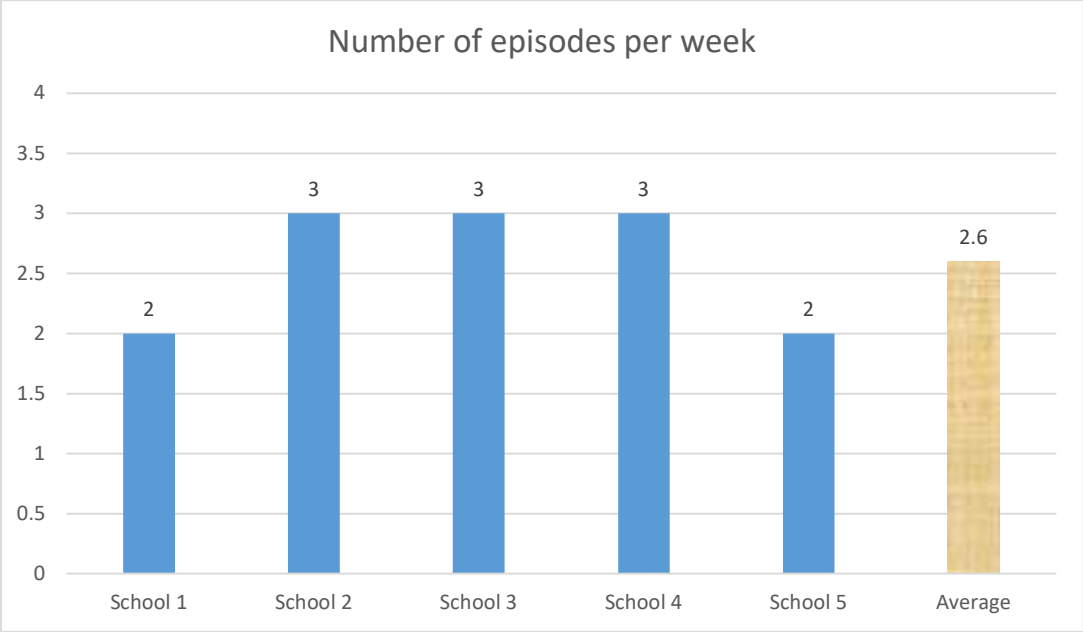

Figure 3.5 Q5: How many episodes of Headsprout do you think is realistic to complete per week?

School 1 suggested the realistic number of episodes to complete per week at 2 commenting the number of episodes per week depends on the age and ability of the pupil.

School 2 suggested the realistic number of episodes to complete per week at 3. They commented although they completed 4 per week in the last school year as part of this project, they felt 3 per week is much more appropriate based on existing school resources.

School 3 suggested the realistic number of episodes to complete per week at 3 per week.

School 4 suggested the realistic number of episodes to complete per week at 3 per week. They commented this was the maximum that could be expected when HER was completed in

addition to the curriculum. If it was part of the curriculum it is possible that more could be completed.

School 5 suggested the realistic number of episodes to complete per week at 2-3 per week. They comment more than this would be too difficult to manage with existing demands on teacher's time.

Item 6 asked teachers to rate the impact that technical glitches had running HER in their school. The scale on item 6 ranged from 1 = no difference to 10 = major difference. Figure 3.6 shows the responses by schools. The average rating across all participants was 6.9.

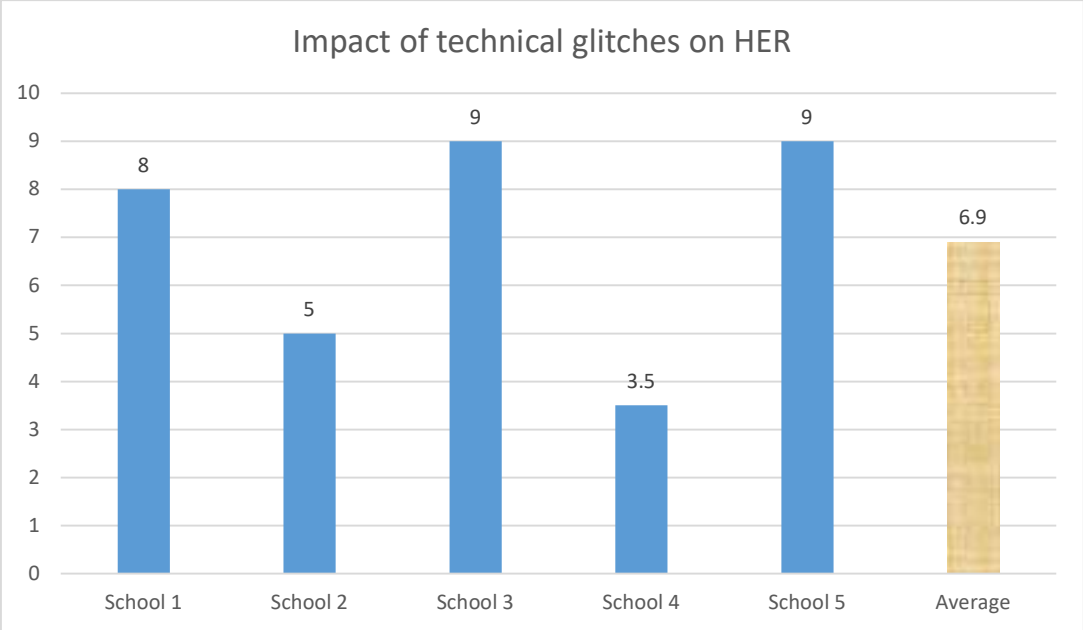

Figure 3.6 Q6: What impact did technical glitches such as the screen "freezing" have on running Headsprout?

School 1 scored the impact of technical glitches as 8. They commented this was very difficult to manage when the teacher was supervising group sessions.

School 2 scored the impact of technical glitches as 5. They commented it meant pupils having to give up on an episode and remembering to come back and finish later. It was frustrating for pupils to have to wait when it froze.

School 3 scored the impact of technical glitches as 9 commenting children got bored and lost interest. It impacted on their motivation to complete episodes.

School 4 scored the impact of technical glitches as 3.5. There we very few technical glitches within this school and when they occurred, the training teachers received on how to move pupils to the next episodes meant they were able to move pupils to the next episode quickly.

School 5 scored the impact of technical glitches as 9. They commented the pupils became frustrated and disengaged and although they children liked the program, they got frustrated when it was buffering and froze.

Item 7 asked teachers to rate how they felt their pupils enjoyed using HER. The scale on item 7 ranged from 1 = did not enjoy it to 10 = enjoyed it a lot. Figure 3.7 shows the responses by schools. The average rating across all participants was 8.3.

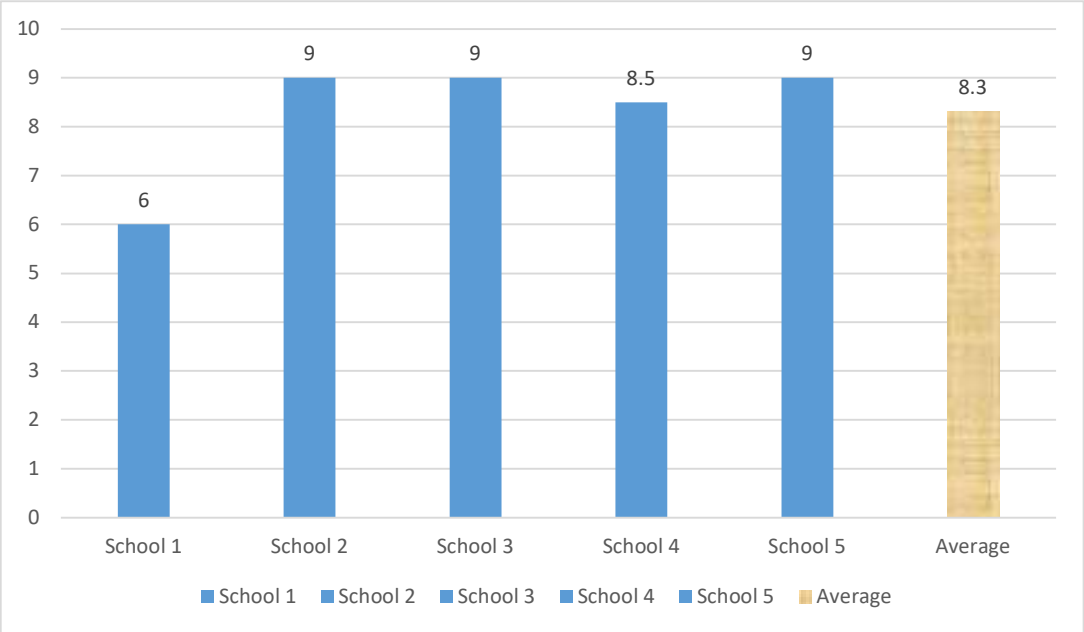

Figure 3.7: Q7. How do you feel your students enjoyed using Headsprout?

School 1 scored pupil enjoyment of HER at 6. They commented there was a mixed response, some children concentrated very well and love it and others needed encouragement ("like they do in everything!")

School 2 scored pupil enjoyment of HER at 9 commenting only 2 of the 15 pupils using the program did not want to have extra Headsprout time when it was offered to them.

School 3 scored pupil enjoyment of HER at 9/10 commenting a large majority of children were willing to participate when it was time to use HER.

School 4 scored pupil enjoyment of HER at 8.5. They commented everyone enjoyed using it and looked forward to being allowed to use it. It made phonics enjoyable and the gaming elements allowed children to learn in a fun way.

School 5 scored pupil enjoyment of HER at 9. They commented pupils became familiar with the characters and became confident in their reading and generally loved HER. The only exception being the times when the program froze.

Item 8 asked teachers to rate what impact they felt Headsprout has had on pupil's literacy. The scale on item 8 ranged from 1 = no impact to 10 = large impact. Figure 3.8 shows the responses by schools. The average rating across all participants was 7.4.

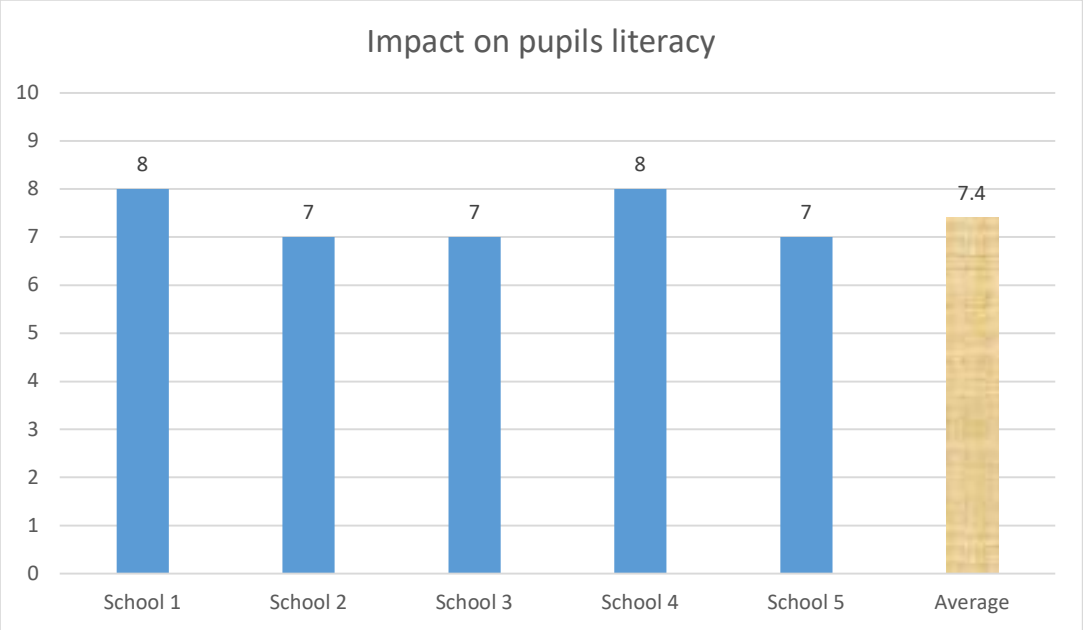

Figure 3.8 Q8. What impact do you feel Headsprout has had on pupil's literacy?

School 1 scored HER's impact on literacy at 8/10 commenting it helped to reinforce phonic skills and raise pupils reading confidence.

School 2 scored HER's impact on literacy at 7/10. They commented all but 2 pupils improved their Pearson Test of English scores during the year. All pupils improved their ability to say and blend initial and final vowel sounds.

School 3 scored HER's impact on literacy at 7 commenting it has certainly helped with phonics and with word recognition, a big improvement was noted in this area.

School 4 scored HER's impact on literacy at 8. They commented it varied from child to child but those who were using it showed positive impact while reading in front of their peers in class.

School 5 scored HER's impact on literacy at 7. They commented that the impact would have been greater if the program worked at all times, but it did have a positive impact because pupils enjoyed it.

Item 9 asked teachers to rate the factors that had the biggest impact on using HER in their school. The scale ranged from 1 = most relevant to 8 = least relevant. Figure 3.9 shows the responses by schools. The factors that had the biggest impact were available slots in the timetable and access to technology and teacher time.

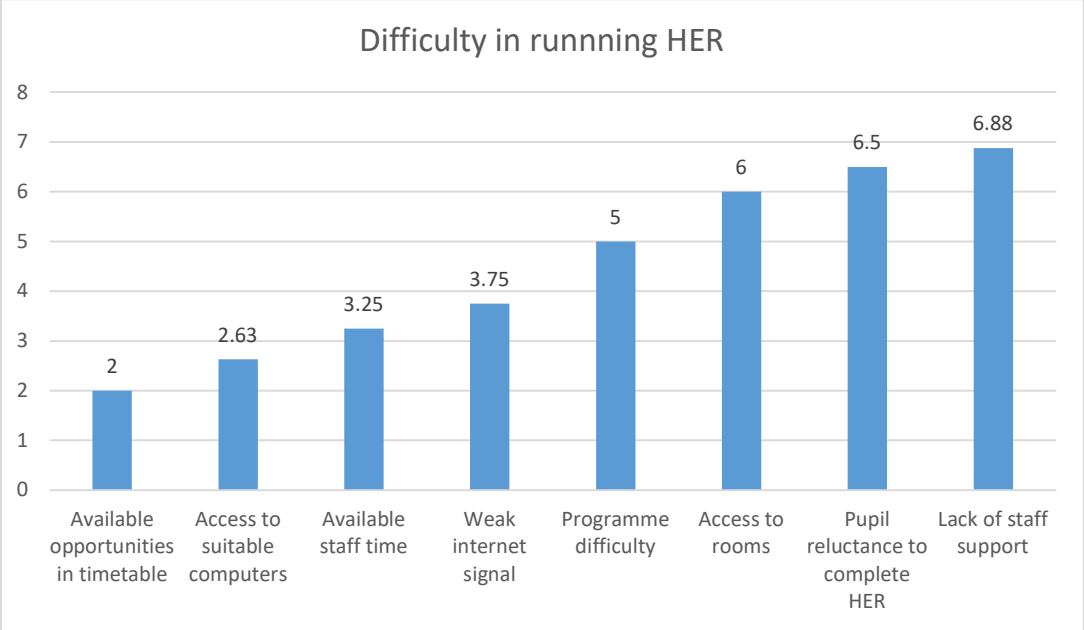

Figure 3.9 Q9: Factors that had the biggest impact on running HER in school.

1. Lack of available time in the school day in addition to existing curricular demands. Score = 2/8.
2. Access to suitable computers/PC/Laptops capable of using HER. Score = 2.63/8.
3. Staff time to supervise sessions = 3.25/8.
4. A weak/inconsistent internet was the 3rd biggest factor in running HER in schools. Score. Score = 3.75/8.
5. Difficulty of HER. Score = 5/8.
6. Pupil reluctance to use HER. Score = 6/8.
7. Available room to completer HER sessions. Score = 6.5/8.
8. Staff support within the school. Score = 6.88/8.

Item 10 asked teachers to rate the most positive factors gained from using HER in school. The scale ranged from 1 = most positive to 6 = least positive. Figure 3.10 shows the responses by schools. The most positive factors were pupil enjoyment and the improvement in reading confidence.

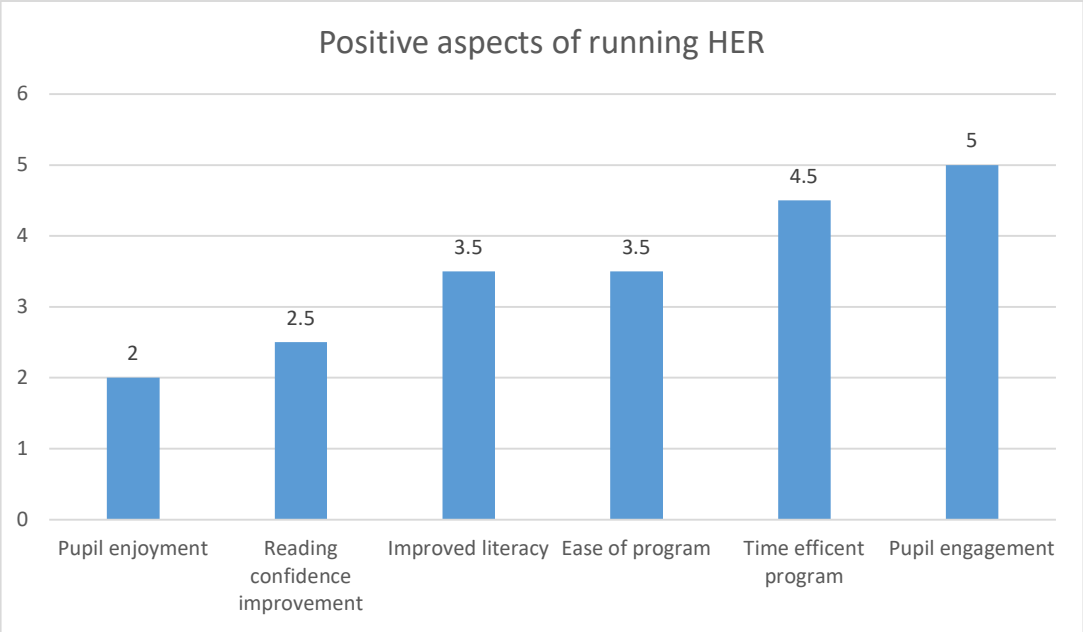

Figure 3.10 Q10: Please rank the following in order of relevance, the positive aspects to running Headsprout in the school were:

Schools rated the most positive aspects of running HER in schools as follows:

1. Pupil enjoyment of HER. Score = 2/6.
2. Improvement in reading confidence. Score = 2.5/6.
3. Improved literacy performance. Score = 3.5/6.
3. Ease of using HER. Score = 3.5/6.
5. Increase in pupil engagement in class. Score = 5/6.
6. HER is an efficient use of teaching time. Score = 4.5/6.

Item 11 asked teachers what they would do differently if they were involved in running HER again in their school.

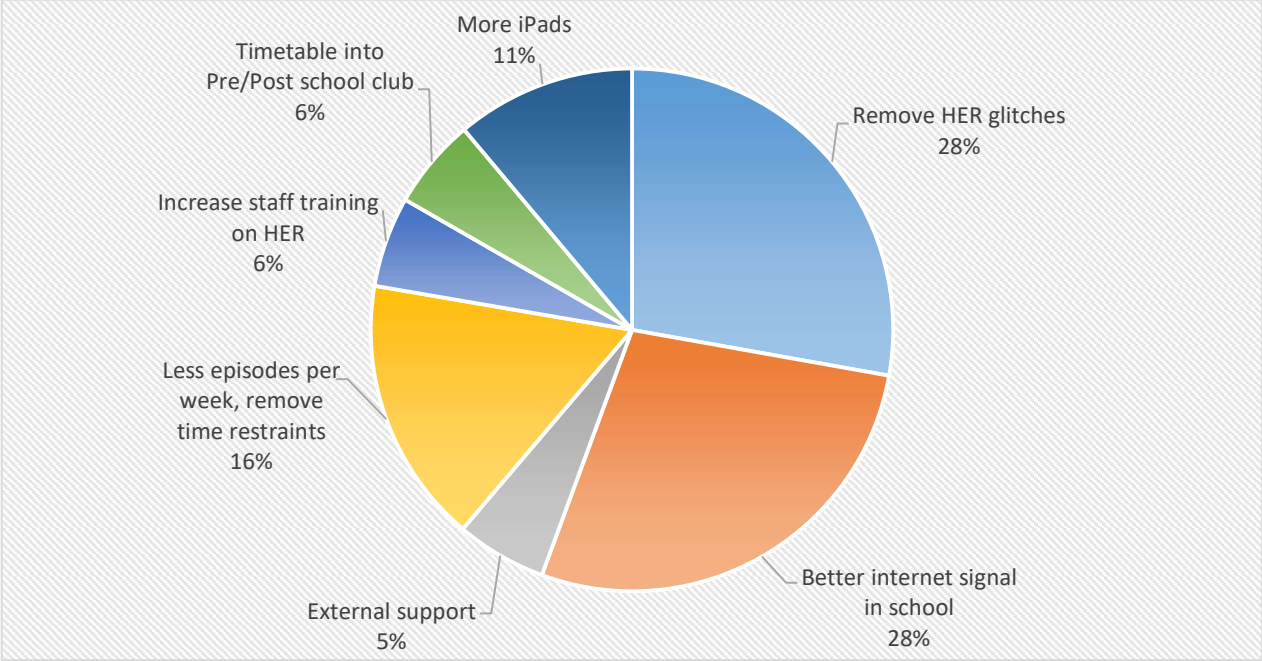

Figure 3.11 Q11: If you were involved in this project again, what would you do differently when running the Headsprout program in your school?

- 28% of respondents answered this question by saying if they could, they would remove the technical glitches within the HER program.
- 5% said external support would enable them to run the program more efficiently.
- 28% said a more consistent internet signal that could handle the number of users would make it a more viable option.
- 6% stated more staff training on HER would benefit the school.
- 11% responded by saying a higher availability of iPads would make HER easier for pupils and teachers to use.
- 16% said attempting 3-4 episodes per week was too many, completing fewer episodes per week would make it easier to run HER. Freeing up time in the school timetable would made it more viable to use.

- 6% stated that timetabling HER into a pre/post school club would be of great benefit to those children struggling with literacy.

Item 12 asked teachers if they had any further feedback they felt may be useful to the research team from their experience of running HER in school.

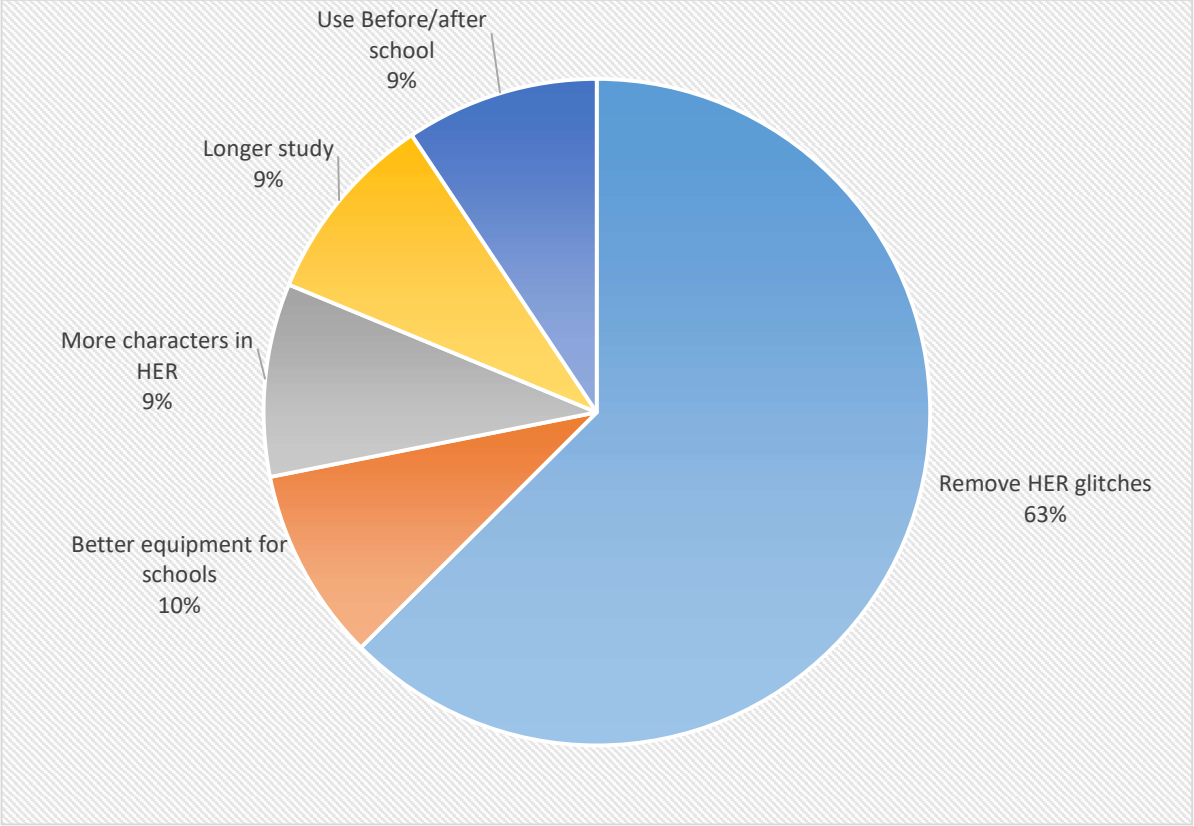

Figure 3.12 Q12: If there is anything else you think would be useful to the research team regarding the running of the Headsprout program in schools, please lets us know:

- 63% of respondents provided feedback that it is important to remove the technical glitches within HER that caused episodes to freeze.
- 10% answered it was important for school to receive improved IT equipment in both equipment and support to run online teaching programs
- 9% stated a longer study including a 1 year follow up would be beneficial to further assess the impact and retention of the skills learn in HER.
- 9% suggested that a greater variety of characters and locations within the program would help increase stimulation for pupils.

- 9% suggested that using HER as a pre/post school learning tool would be an excellent option allowing more time to complete the program and the ability to focus on those pupils who needed literacy support the most.

4.4 Discussion

The aim of this study was to elicit and evaluate teachers' opinions on using HER in primary schools. Results indicate that teachers reported high levels of satisfaction with the content, impact on literacy. and pupil enjoyment of the HER program. Teachers reported that the individual phonological knowledge that HER delivers is beneficial and commented that this can be difficult for teachers to achieve while trying to teach a full class. However, common themes in responses highlighted that technical issues experienced in some schools limited program effectiveness in terms of pupil progress and motivation. Additionally, existing time pressure to teach the curriculum resulted in difficulty in facilitating the time needed for HER.

The issues of technical difficulties are complex as it is unclear where the problems existed. Various factors could cause technical problems in individual schools, including age, suitability and availability of school hardware, strength and consistency of school internet signal, teacher competence in ICT, pupil competence in ICT, and technical issues within the HER program itself, and/or server. The issues identified were similar in each school, with reports that episodes froze midway through, meaning pupils were unable to progress through episodes or make any changes to the screen. Although teachers had been trained how to logon to the HER system and progress pupils to the next episode, they reported that the episode freezing was a demotivating factor and impacted on pupil progression. The availability of suitable equipment also negatively impacted on school progression through the HER program. Structural inequality was evident across schools in the different number of iPads and modern laptops available. The process of accessing the HER program on PCs/Laptops compared to iPads is notably different. Access via a PC/Laptop requires initial logon to the C2K security network used in all N. Ireland primary schools. This can take up to up to 10 minutes to complete depending on the PC/Laptop and internet signal. Pupils must then logon to the HER website via use of an individual username and password/picture. In addition to

the 30 minutes required to complete an episode, this extra logon time was an issue for schools and impacted on the ability to compete the HER program at four episodes per week. Conversely, iPads do not require either of these logon processes. HER is accessed by tapping the HER app on screen, then tapping the users name and icon. This can be completed in 10 seconds. Whereas School 2 was able to have their participants complete the entire program on individual iPads allocated to each pupil for the duration of the research, School 3 used older PCs to run the HER program. It is therefore hardly surprising to note that School 3 scored the question "what impact would better school technology have had on your ability to run the HER program at 10, while School 2 scored the same question 0.

The technology issues may have also impacted on the answers given to the question of the viable number of episodes per week. The only school to exclusively use iPads to run HER, School 2, completed 4 episodes per week throughout most of the duration of the study. However, they suggested 3 per week was a more realistic number. This suggests that School 2 made a major effort to hit the target set for the 6 month duration of this research, but that this may not have been sustainable over a normal school year. The average viable number of episodes suggested by schools was 2.6 per week when HER was to be completed in addition to the requirements of the curriculum (the actual number of completed episodes per week was 2.06 episodes with an average duration of 30.88 minutes). To complete the program at this rate of progression would take approximately 31 weeks of term requiring HER to begin in schools in September. Primary schools operate within a tightly scheduled timetable to ensure they meet the requirements of the national curriculum. With an average teaching time of 21.5 hours per week per teacher, finding time to use additional resources such as HER can be very difficult. An interesting comment from a deputy principal was that for HER to be used in schools, it would have to replace an existing literacy teaching method and would require whole school support. Overcoming scepticism and resistance to replacing tried and trusted

methods would be a challenge in such situations, as reported by Storey et al (2019). However, the literacy attainment results reported in Study 1, and the fact that schools were able to use HER without the need for external staff and resources, should act as positive evidence on the benefit of such changes.

Schools reported that the longer the research progressed, the more comfortable they were with the demands of the program. Although few schools embedded HER into weekly timetables, it became part of teacher/pupil routines to complete episodes on an ongoing basis. School 4 commented that having an external person coming in to supervise HER lessons would have been difficult to manage as schools are so busy managing existing timetables and resources which often change daily. The need for a team of HER staff as opposed to an individual became clear during this research. Although only one teacher from each school received initial HER training, by the end of the research each school had internally upskilled between two and four staff members with the competency to run HER sessions, reducing the demand on one single staff member. When a team approach was used, schools reported they felt much more able to cope with the demands of the program. These demands may have lessened if HER had been incorporated into the entire school timetable for class wide learning, as opposed to being used as a catch-up intervention for pupils struggling with literacy. When asked if this would have made a positive difference to their ability to run HER, 3 of the 5 schools responded positively that they felt it would have.

Incorporating HER into the timetable via a school wide approach and ensuring buy-in from all teachers would require the commitment of the school leadership team, including the principal and the board of governors. Furthermore, recommendations from bodies such as Department of Education based on the results of this and other similar research would act as powerful motivation for schools to implement educational programs with a strong base of evidence to support their efficacy. Such recommendations would help ensure use of such

programs are seen as a mandatory change rather than an optional extra learning resource. School 4 suggested that rather than incorporating HER into the existing timetable, HER could be used in a pre/post school setting to ensure pupils had the resources and time to complete it. This mirrored the approach of School 2 in which pupils often completed episodes upon entry to school each day just before other classes began. This approach would allow disadvantaged children to be directly targeted without the loss of existing teaching time helping provide the opportunity build literacy confidence. As home environments of disadvantaged children are often not suitable learning environments in terms of availability of books, overcrowding, hunger, and adults to read with (Kellett & Dar, 2007), homework clubs before and after school could provide a vital learning opportunity.

The fact that pupils were willing to complete episodes before other lesson begun in the morning suggests a high level of enjoyment of the HER program. This is reflected in the teachers' comments regarding pupils enjoyment of the HER program. These included "I was actually able to use HER as a reward for completing other work", "only 2 of the 16 pupil asked didn't want extra HER time each day, "Most kids loved it and the gaming element allowed them to learn in a fun way". The question regarding pupil enjoyment of HER scored the highest of all questions indicating that the program has an appropriate blend of fun and learning. Pupil enjoyment of learning resources is important in a similar way that teacher endorsement and commitment is. Teachers' opinions on HER's impact on literacy was also very positive. These correlate with the assessment results in chapter 2 which demonstrated exponential gains made by pupils using HER in comparison to those receiving teaching as usual.

The main themes that emerged from teacher observations and comments were a positive impact on teaching, reinforcing knowledge of and pronunciation of phonics, improvements in word recognition, and noted improvements in pupils' reading confidence. Crucially, pupils

were also more willing to read both individually and in groups in front of their peers than they before using HER. Although pupils who enjoy reading tend to have a higher level of literacy attainment, pupils from poorer backgrounds tend not to enjoy reading as much as their better off peers. Developing a private confidence develops pubic reading confidence. HER appear to allow this private confidence to build based on its 1-1 approach which resulted in a welcome increase in public reading confidence.

Factors such as the ability of pupils to use HER, finding space to complete sessions, pupil reluctance and a perceived lack of support from other staff weren't indicated as difficulties in running HER in schools. However, finding time in the school day to run sessions, obtaining access to suitable computers/iPads, available staff time to supervise sessions, and an inconsistent Wi-Fi signal, were. These reflect key areas of Ely's framework for effective implementation of innovative educational technology. The most elusive of these factors within this study was the availability of suitable resources such as hardware and teacher time. Teachers in this study reported they had the required ICT skills to use HER as intended. They wanted to improve literacy and understood the need for innovation. They felt they were given time in advance to prepare for its implementation and attend training. Access to resources in terms of suitable computer equipment and teaching time was difficult. This was shown by the fact that only one school out of five was able to have the majority of pupil compete the program. Budgets cuts and the method of calculating addition pupil payments via the common funding scheme have impacted some schools more than others. The hardware available varied greatly from school to school which impacted on how long it took to access HER, complete an episode, and the likelihood of the program freezing because of Wi-Fi or computer problems. Teacher workloads are high, and in the last 2 months of terms teachers reported their available teaching time lessens because of an increase in summertime outdoor activities. This was reflected in the results of pupil progress, in the first 3 months of the

program, an average of 10 episodes a month were big completed. Towards the end, this had decreased to around 5 per month.

The results of the questionnaire reflect the need for appropriate planning, resources allocation, and whole school support when attempting to implement new educational technology. Programs such as HER cannot be seen as a task to give to a teacher in isolation to learn, implement, and monitor on top of their existing job and duties. This is unsustainable and can often result in effective programs being labelled as ineffective; the reality is often that the school environment was not suitably prepared for their implementation. A full analysis of program contents and demands must be carried out before schools consider their purchase. If a school considers it does not have the required resources in terms of teacher time or hardware to use an educational program as intended, they may be better served using the funding elsewhere. Once the requirements are known, teacher time should be allocated accordingly to meet the demands of the program. The message should come from the school leadership team as to why a particular program is being implemented, the expected gains based on available research, and what will be expected from each staff member. Appropriate technology must be used when required, which may involve advance testing of PCs/Laptops/iPads/Tablets to ensure technical suitability. Allocating slots in the timetable over the entire school year also appears to be very important. When school leaders examine the data on poor literacy performance within their school, regionally and nationally, evaluating and replacing ineffective parts of their literacy methods and resources with programs with an evidence base of effectiveness such as HER should be common sense. Improving the knowledge of evidence-based practice is a key component of this for both school leaders and teachers. This is key to getting the required teacher support; a positive impact on pupil learning is ultimately what drive most teachers into their profession (House of Commons Education Committee, 2017).

Limitations of this study are that although participants were asked to provide both numeric and written answers to each question it was not possible to probe the responses further. Additionally, the SI may have missed key information about using HER in schools in the way the questionnaire was designed. Teachers only answered the questions they were provided and may not have added in other information they felt was important.

The aims of this research were met as all teachers answered all questions and provided important information on the use of HER in schools. The results suggest the challenge facing schools is creating a suitable environment, whereby effective educational resources can be implemented, supported and ingrained in the culture of the school, in a way that facilitates a positive impact on learning for pupils and teachers. Technology is simply a tool; teachers are the key to unlocking its potential. Creating an environment where teachers are supported to do so is the challenge schools face but one, as the literacy improvement displayed in chapter 2 has shown, that will be of enormous benefit to all concerned if achieved.

Chapter 5: General Discussion

5.1 Aims of the research

The aim of this thesis was to evaluate the impact of the HER literacy program on the reading ability of disadvantaged children in Northern Irish primary schools, when compared to peers in the same schools receiving teaching as usual. An additional, but just as important aim, was to evaluate schools' ability to implement the HER program independently, and to obtain teachers' feedback on the challenges of doing so. Previous research into HER in N. Ireland had been on a small scale, with studies employed approximately 5-15 participants. Additionally, external support in the form of research teams were responsible for implementing the program in schools. This programme of work employed a sample size to 123 pupils across eight schools and necessitated school staff schools to use HER with only minor support from the research team, to increase the social and ecological validity of the program.

The results of the study, presented in this thesis, demonstrate the efficacy of HER in improving the literacy performance of disadvantaged pupils. These pupils had been identified as those struggling with literacy and falling behind the performance of their non-disadvantaged peers. This attainment gap presents significant negative effects on the educational and life prospects of such pupils, limiting the level of qualifications achieved, employment prospects and personal health and wellbeing. This research demonstrated that as well as improving literacy performance, use of HER was effective in exponentially closing the literacy attainment gap in a way that teaching as usual was not for these children. Additionally, this research demonstrated the capability of schools to run the HER program independently, albeit at a lesser frequency than initially targeted. The feedback gained from responses to a questionnaire on running the HER program has provided a useful insight into challenges facing primary school teachers when introducing new educational technology and the environmental conditions required for successful implementation.

Study 1 evaluated the use of HER in comparison to teaching as usual with disadvantaged children with identified literacy difficulties. The results of the study supported the implementation of HER to effectively and efficiently improve reading skills in this population. Pupils in the treatment group exposed to HER lessons over a 6 month period significantly outperformed pupils in the control group in relation to increases in sentence reading age, phonics age and fluency in phonic identification. Use of HER also decreased the gap between chronological age and sentence/phonics reading age significantly for the treatment group in comparison to the teaching as usual control group, with pupils in the treatment group gaining on average 10 months for SRA and 7 months for PRA.

Study 2 evaluated the ability of schools to run HER independently. A target of four episodes per week was agreed with each school at the beginning of the research to allow completion of the program within 6 months. Although only one school was able to meet this target, schools were able to complete a mean figure of 2.06 episode per week. While this meant that four out of five schools didn't complete the entire 80 episode program, completing 2 episodes per week over an entire school year of 36 weeks would allow program completion. Schools' ability to use HER independently should not be judged based solely on the 6 month timeframe of this particular research; their ability to implement and maintain lessons using existing resources was the focus of the evaluation and in this respect, and in all cases, the schools were successful in doing so. Teachers developed the required skills to run HER effective and, importantly, the majority of schools continued to use HER following the conclusion of the 6-month research period. This indicated that the social and ecological validity of HER was increased by having schools learn and develop the expertise required to use it independently.

Study 3 was a mixed method study, eliciting qualitative and quantitative data and feedback from the teachers who were coordinating HER within schools. The results indicated that

although teachers found HER to be effective in improving literacy and reading confidence, and that pupils reported a high level of enjoyment, environmental conditions within schools increased the challenges of using it. Unsuitable technology and pressure on teacher time meant schools were not able to complete as many episodes as had been agreed at the outset of the research. Furthermore, outdated computer equipment and technical glitches within the HER program itself, caused pupil frustration and slowed the process to a level which impacted on the number of episodes completed.

Generally, the aims of this thesis were met, and results obtained indicate that this research will add to an evidence base that demonstrates the use of HER is effective method of improving literacy performance among disadvantaged children with literacy difficulties. Additionally, results provide data on the viable number of episodes that schools can complete when running HER independently, in addition to the curriculum and the challenges faced therein.

5.2 Summary of findings

Study 1 (Chapter 2)

This study evaluated the impact of a systematic, phonics-based literacy program, Headsprout Early Reading, on the literacy performance of a treatment group of disadvantaged, underperforming pupils, in comparison to a peer control group, who received teaching as usual. The key research question was whether use of HER would significantly improve literacy performance in terms of sentence reading age (SRA), phonics reading age (PRA) and phonics identification fluency via a flashcard identification test (FIT). Schools were randomly assigned to a treatment or control group. Participants were pupils with literacy difficulties, identified by teachers in each school. The treatment group used HER with approximately 15

pupils up to four times per week, timetabled at the discretion of each school. The control group continued with existing school teaching and literacy interventions as usual.

Baseline assessments were carried out with all pupils to identify SRA, PRA and FIT rate of response. FIT was repeated at the midpoint of the research, at approximately 12 weeks. Post intervention assessments were carried out with all pupils to compare changes in SRA, PRA and FIT between pupils using HER and those receiving teaching as usual. The results demonstrated that use of HER was effective in significantly increasing SRA, PRA scores and FIT rate of response for pupils in the treatment group compared to those in the control group. The average increase in SRA was approximately 17 months for treatment, 7 for control. The average increase in PRA was 13 months for treatment, 7 for control. The average increase in rate of response for correct answers for the FIT was 38.87 for treatment, 21.63 for control. The average decrease in rate of incorrect answers for FIT was 12.14 for treatment, 3.79 for control. These results were consistent with previous studies (Twyman, Layng & Layng, 2011; Tyler, Hughes, Beverly & Hastings 2015; Watkins et al, 2016; Storey, McDowell & Leslie, 2019) on the efficacy of HER as a literacy intervention. Additionally, it supports Huffsteder et al, (2010) and Twyman, Layng & Layng, (2011) who demonstrated significant literacy gains achieved from partial completion of HER.

Although pupils in the control groups receiving teaching as usual improved their literacy performance in each assessment, the improvements were much smaller than those seen in the HER treatment group. Independent sample t-test showed no significant difference in SRA or the PRA between the treatment group and the control group at baseline. However, Independent sample t-tests showed significant post intervention difference in SRA between treatment group (M= 78.50, SD=8.271) and control group (M=67.11, SD=9.306); $t(89)=5.98$, $p = 0.0001$, and a significant difference in PRA between the treatment group (M= 71.80, SD=8.057) and control group (M=62.14, SD=9.540); $t(89)=5.049$, $p=.0001$ post-intervention.

Pupils in the treatment group also experienced an exponential reduction in the gap between the chronological age and SRA/PRA. The mean gap between chronological age and SRA at baseline was 24 months in the treatment group and 26 months in the control group. Over a six-month period, the mean gap between chronological age and SRA in the treatment group had decreased by 10 months to 14 months (Treatment) and by 3 months to 23 months (Control). Similarly, the mean gap between chronological age and PRA at baseline was 28 months in the treatment group and 31 months in the control group. Post intervention, the mean gap between chronological age and PRA had decreased by 7 months to 21 months in the treatment group and by 3 months 28 months in the control group. Over 6 months, pupils using HER experienced a statistically significant 10 month and 7 month decrease in the gap between their age and their SRA and PRA; over the same period pupils in the control group experienced only a 3 month decrease in the gap between their age and both their SRA and PRA. Use of HER therefore changed the trajectory of learning. Pupils who used it accelerated their learning and literacy performance at a much faster rate suggesting continued use of this, and similar evidenced based approaches who do more in less time, may close the attainment gap more effectively.

The FIT results mirrored those of the SRA/PRA. Pupils in the treatment group increased the rate of response for correct answers by more than double that of the control group. They also decreased the rate of response for incorrect answers by more than four times that of the control group. Worryingly, in two of the three FIT assessment, pupils in the control group performed more poorly after a period of 3 months learning than at baseline. Their mean scores from midpoint to post intervention in FIT 2 & 3 for rate of incorrect scores increased, despite 12 weeks of teaching and literacy interventions. This indicates that teaching as usual was not only ineffective in closing the attainment gap, for some pupils, the gap may have increased over time. This was not the case with any of the HER groups.

What constitutes 'teaching as usual', is problematic for researchers to quantify or qualify as it typically involves an eclectic mix of resources, methods and interventions. Therefore, what schools are utilising, and how they make decisions on what strategies to employ, requires immediate review. Results of this research, and others conducted in NI schools (Storey, McDowell & Leslie 2020), along with performance figures from DENI, (2015, 2019) demonstrate that an eclectic approach is not always effective for this population; the implications of ineffective strategies for children struggling with literacy in terms of education and future wellbeing are profound. Too many children are still leaving primary school below the expected reading level, and without a more systematic evidence-based approach this is unlikely to change. It is difficult to argue that the blame lies with teachers who are clearly trying their very best in what have been very difficult circumstances over the past decade. However, the decision makers within schools, local education boards and government must address the fact that ineffective teaching methods endure, despite clear evidence that they are not effective.

Central to this is the use of EBP. EBP needs to become part of the teaching vernacular and replace the reliance on anecdotal evidence and eclectic interventions that currently predominate. Medicine has shown the necessity and benefits of cultural shifts towards EBP. Attitudes and culture can change and improve, but changes must come from the top down and should be the result of partnership between schools and research centres of excellence. In N. Ireland this expertise and research capacity exists in Universities; partnerships with schools should be further nurtured through collaborative education, to develop and encourage continuous improvement and learning from research. As seen in Chapters two and three of this study, in addition to dramatically improving the literacy performance of pupils, empowering schools to run the intervention with existing school resources increased the

social and ecological validity of the HER program and helped build the capacity within the schools to ensure it continued post research.

Limitations of this study were the failure of schools to meet the target of 4 lesson per week which resulted in only 1 school from 5 having the majority of pupils complete the entire HER program. A longer study over an entire school year would have provided greater opportunity for program completion. Despite this and in support of previous studies of the impact of partial completion of HER, significant improvements in literacy performance were still evident.

Study 2 (Chapter 3)

Study 2 evaluated the ability of schools to run the HER program independently. Previous studies such Storey, McDowell and Leslie (2017), which evaluated the impact of HER in N. Ireland primary schools using external research teams to run the intervention, found that, at the conclusion of the research, despite significant gains in literacy skills, schools didn't carry on using the HER program. When the researcher's expertise in running the program was no longer available, schools didn't have either the necessary skills, resources or desire to carry on using it. This research suggested that schools' lack of adoption of evidenced based approaches required further investigation. This was addressed in this study by training internal school staff in the use of HER in advance of the research with the aim of having schools run the HER program independently. All technical requirement such as the need for Laptops/PCs/iPads/Tablets and Wi-Fi/wired internet were discussed with each school prior to the start of the research. Schools were informed that 4 episodes per week would take approximately 1.5-2 hours to complete and that sessions would require teacher or classroom assistant supervision. Results indicate that the five schools in the treatment group were able to complete an average of two episodes per week over the six months of the study. There was

a predictable variation in episode completion between schools, and it appears that the autonomy of staff to decide their own timetables, and the allocation of staff to the HER research, made variances in progress inevitable. However, there was also a variation in rate of completion based on the time of school year (Christmas to Easter and from Easter to Summer) which the research team had not initially considered as a factor, but one which proved significant in terms of available teaching time. Within School 2, pupils completed episodes first thing in the morning upon arrival into school. Although HER wasn't a part of the official timetable in any school, in effect it became so in School 2. In all other schools HER was completed on an ad-hoc basis, based on computer and teacher availability. The results show clearly that School 2's approach was most effective. School 2 has the highest performance in terms of episodes completed (average of 77/80), time spent on HER (39,103 minutes total) highest average end episode (77), highest improvements in sentence reading age (19 months), 2nd highest increase in phonics reading age (13 months), highest increase in FIT correct scores (+47.55) and the 2nd highest decrease in FIT incorrect scores (-16.27). School 2 spent almost double the amount of time on HER than any other school.

A major factor in this was the input and commitment of the HER contact within this school. This teacher was passionate about the opportunity to try and help pupils improve their literacy. They championed the program from the outset and ensured the best resources were available to participants throughout; participants used iPads allocated to them for the duration of the program, as suggested as best practice by the SI during the teacher training stage. Additionally, the teacher had access to a classroom assistant for the duration of the research to help facilitate lessons, support pupils and deal with any issues that arose. This additional allocation highlights how support from the school principal for the HER program was prioritised and resources were allocated accordingly. This reflected a school wide commitment to the implementation of educational technology that echoed many of the factors

outlined in the framework provided by Ely, (1999), as vital for the introduction of such technology.

Other schools didn't have access to iPads and support staff to the same extent as School 2, and the results obtained reflected this. Whereas School 2 was an outlier in terms of time spent on HER, the four other schools produced similar results, with the total time spent on HER ranging from 17,444 to 23,765 minutes. It was notable also how the time spent, and number of episodes completed decreased as the school year progressed. In the first half of the research from January to March (baseline to midpoint) an average of 10 episodes per month were completed within the treatment group. In April/May this decreased to approximately 6 episodes per month, then again in June to an average of just 2 per month. This reflects the decrease in teaching time available to teachers at this time of year when there is a noticeable increase in out of classroom activities. For certain subjects such as geography and sports this would of course be of great benefit. However, for pupils struggling with literacy who may require explicit instruction, this is a loss of teaching and practice time that has a major impact on their literacy skills.

For key interventions such as supplementary literacy support, schools may have to prioritise this learning over external activities and ensure pupils who require a higher level of support and teaching intensity, receive it for the entire 36 weeks of the school year. Conversations with school staff confirmed, albeit anecdotally, that term three has less available teaching time than term two. Importantly, when asked if timetables reflected this, i.e. is more work timetabled in term two than term three, the general response from teachers and principals was that teaching is expected to be maintained at the same level throughout the 36 weeks of the school term. However, the data from this investigation shows that at certain times of the academic year this proves more difficult for staff to do. This may be a topic that requires further research, across a larger number of schools in order to better inform time planning,

allocation of resources and decision making to occur based on the reality of available teaching time at different point in the school year.

As well as the number of episodes completed, the fidelity of implementation of the HER program has been shown to be an important factor in the impact it can have on literacy performance. Watkins et al, (2016) aimed to deliver HER in two schools at the rate of 3 episodes per week, over 19 school weeks, covering term 2 (Jan-March) and term 3 (April-June). Schools had the option of requesting implementation support via school visits, emails and phone calls. School A declined assistance whereas School B accepted it. Similar to the findings of this study, school staff struggled somewhat to ensure pupils completed the suggested number of episodes each week. School A seemed to implement the HER program more efficiently than School B as it completed an average of 2.4 episodes per week as compared to 1.4 per week for School B. However, although School A completed more episodes, the fidelity of implementation was not as robust as School B. More benchmark assessments, monitoring of pupil scores, reading of sprout stories and fluency building exercises were carried out in School B; assessment results indicated the School B also achieved greater improvement in literacy performance than the School A. This suggests that additional time should be provided for staff to complete the tasks designed to support learning in addition to the 80 episodes of HER. Ensuring pupils complete episodes is not sufficient; checking and reinforcing the learning may increase the impact HER has on literacy performance and should therefore be woven into how the program is used.

The availability of suitable computers to facilitate the use of HER varied between schools. Despite the fact the SI advised schools that HER is best completed on iPads, only two of the five schools facilitated iPad access for the duration of the research. The three other schools relied on existing PCs and Laptops, the quality and suitability of which varied between and within schools. School 2, where pupils had allocated individual iPads, completed the highest

number of episodes. School 3 completed the second highest number of episodes by facilitating use of PCs in a large computer suite. The HER contact informed the SI that they had access to this room whenever they needed as there were plenty of working PCs within the school. School 4 completed the third most episodes. Although pupils were using PCs to access HER, the time spent logging onto the C2K network and then accessing HER via the website reduced the available time. Therefore, pupils in School 4 began using iPads midway through the research. Schools 1 and 5 completed the fourth and fifth highest average episodes, 39 and 31 respectively. Both schools used a combination of iPads and PCs depending on availability. Login time to the HER program on older PCs was up to 10 minute and additionally in School 1, the Wi-Fi signal was inconsistent and often unavailable. This resulted in HER program freezing in the middle of episodes which often required a teacher reset. This inconsistent approach to completion of the HER program impacted on the progress made by individual pupils, and the schools in general. This leads back to the structural inequality schools encounter. The challenging economic climate endured by schools from 2009-2019 has resulted in decreasing funds and increasing costs associated with more mainstream and SEN pupils in schools. Clearly, whereas some schools were able to allocate funding to maintain a suitable level of educational technology, others were not. As well as the access iPads varying greatly, access to up to date PCs and laptops also varied. The schools which had either use of iPads or high quality, well maintained PCs/Laptops completed the most episodes. The schools that completed the least number of episodes commented that demands from other teachers and subjects limited access to the required access to iPads/computers when required.

The issue of core school funding and the additional common funding scheme is complex and controversial, and many suspect these additional payments are simply used to plug holes in the school budgets rather than being directly applied to the needs of disadvantaged children

(Salisbury, 2013). This may then impact on access to up to date technology. In this study, the lack of appropriate technology directly impacted on the level of program completion. Schools with sufficient resources completed more of the program and generally benefitted from higher levels of attainment thereof. Most would agree that pupil attainment should not be limited by the availability of technology. Additionally, it is clear the implementation of new educational technology into school needs a whole school approach with the necessary level of commitment and funding from school leaders. This study would suggest that the implementation of educational technology in school requires either the addition of resources (increased teacher time and equipment) or the removal of existing teaching methods or resources. In terms of literacy, this may mean the partial or full replacement of aspects of the eclectic approach to literacy current in use.

The baseline assessments carried out in this study illustrated that the average gap between chronological age and sentence reading age was approximately 25 months per pupil. This is reflected on a large scale each year through Department of Education statistics that show many disadvantaged children leave school less qualified than their more affluent peers. Clearly, many of the strategies employed by schools to target literacy difficulties are ineffective. The difficulty previously identified by Storey, McDowell and Leslie, (2020) of evaluating and comparing "teaching as usual" (a variety of methods and interventions) with programs such as HER, an evidence-based, sequenced and systematic intervention must be addressed. Research is necessary to identify and evaluate exactly which strategies and teaching materials are effective and those which are not. The results of such research will demonstrate the availability and efficacy of evidence-based practices and inform decision making regarding which aspect of literacy intervention are not fit for purpose. Such research will also empower teachers with the knowledge they need on the most effective teaching methods available. Additionally, the need for suitable training in advance of the introduction

of educational technology and ongoing support in terms of time, technical expertise and whole school is key. Removing the fear associated with the use of technology and the ongoing reluctance to use it (BESA, 2019; Hadyn and Barton, 2007; Oldfield, 2010) is only likely to happen via competence training. Increasing demands on teacher time also limit the desire and/or capacity to use ICT in the classroom (Bingimlas, 2009). Often teachers will maintain existing methods with which they are able to fit into their current practice, rather than adopt new methods and resources which are often seen increasing their workload. Additionally, perceived craft knowledge built on years of experience can be difficult to change (Barth, 2001).

Changing this culture is key. To achieve staff support of new strategies, a partnership approach involving consultation, communication and participation with staff at all levels of schools would be beneficial. Involving teaching staff in the process of improving knowledge of evidence-based practice, purchasing of resources and an evaluation of the effectiveness of existing teaching methods is more likely to achieve their endorsement than a top down, management led approach lacking consultation and cooperation. This process may also involve working with teaching unions to facilitate the implementation of new processes. The exclusion of unions in teacher conditions and workloads has been found to be counterproductive in the past (Farnham, Horton &White, 2003).

Clearly, staff approval is key in the implementation of new educational technology. This study involved staff from the outset by carrying out the necessary training to ensure they were confident and competent to run the HER program, facilitating Q&A sessions and offering ongoing support to school contacts albeit via light touch support. This may have had the added effect of developing a sense of ownership of the program that helped ensure it endured when the research had finished. The majority of schools continued to use HER in the school year following the end of the research. All schools had been informed of the results

obtained (Chapter 2, Study 1) by their pupils, and were therefore able to use these results in annual presentations by principals and senior staff to the board of governors, and to members of Ofsted inspection teams. The SI was informed in subsequent discussions that the HER assessment results had often mirrored improvements seen via annual GL test results; again, likely to act as a powerful motivation to continue use of the HER program. One school principal commented on the importance of follow up research on the impact of HER beyond the end of the six month research period. This is an area which future research could explore. Although the evidence for HERs efficiency exists, evidence on the longevity of its impact on literacy attainment is currently limited.

(Study 3, Chapter 4)

Study 3 used qualitative research in the form of a questionnaire to obtain feedback from the teachers using HER with pupils in the treatment group. Teachers were asked to respond to 12 questions in order to provide more information on their experiences and challenges of running HER. The questions focused on potential time pressure, availability and suitability of technology, pupil participation, observed benefits of HER and whether the current school environment was conducive to using educational technology, in addition to the existing demands of the curriculum. A high level of satisfaction with both the impact of HER and pupil enjoyment were reported by participants. This combination was important as these factors are not necessarily mutually exclusive. A program that helps improve literacy, but which pupils do not enjoy using, is unlikely to be maintained. The same could be said of a program that pupils enjoy using, but that has little impact on literacy. However, the latter is perhaps more likely to be maintained. It is important to note here that the careful development and refinement of HER by educators and behaviour analysts has meant that it not only utilises many teaching strategies known to be effective (promoting hierarchies,

reinforcement of individualised learning, and built in assessments), but that it is presented in a way that engages and motivates the user through animation and game based activities.

One of the most positive aspects of the feedback received was the reported increase in reading confidence in pupils using HER, a vital ingredient in the development of reading skills (Cox & Guthrie 2001). Pupils from disadvantaged backgrounds often are not afforded the opportunity to build reading confidence at home due to lack of books, suitable space and privacy combined with a lack of experience of reading by parents (Neuman & Celano, 2001). HER allows pupils to develop and practice reading skills, from both screen activities and books from an early stage in the program. Teachers reported pupils displayed a new willingness to read in front of their peers in a way that they had not previously shown. Additionally, teachers reported pupils were more willing to read for pleasure at times when books were available. Reading for pleasure has generally not been observed in disadvantaged children at the same frequency as it has in their non-disadvantaged peers (Cox & Guthrie 2001; Neuman Celano, 2001). However, the pupils using HER in this study began to exhibit this behaviour, which is a very encouraging sign for their future reading development. A further positive impact identified was an impact on the pronunciation of phonics as well as improvements in word recognition mirroring the results obtained from chapter 2 (Study 1). Although anecdotal, such comments, in combination with results of literacy assessments, paint a promising picture of the impact HER may have on future literacy performance. Future research would benefit from a researcher having access to the annual school test results which may reinforce the anecdotal evidence given by teachers in this questionnaire as to HER's impact on literacy. However, the fact that teachers reported HER had a positive impact on literacy is in itself significant; teachers are likely to disseminate a more positive attitude about the impact of this educational technology based on their involvement and the results obtained.

This is a vital component for an increase in knowledge and uptake of effective educational technology (Na, 1993; Francis-Pelton and Pelton, 1996; Al-Oteawi, 2002; Berner, 2003).

Answers to the questionnaire indicate the challenges of using HER in schools centred on two main areas: finding time in the school day to schedule use of HER and the impact of unsuitable technology within schools. When initially meeting with school staff, the SI asked for a HER contact to be established in each school. In hindsight, creating a team of contacts would have reduced the pressure on individuals within schools to organise the lesson for all pupils. Over the course of the research, the number of HER contacts in schools grew organically as teachers asked for more support from other staff members. Whereas each school had one HER contact at the beginning of the research, by the end there were teams of between 2-5 people operating in the HER contact group within each school. This demonstrated how schools were able and willing to adapt to the needs of the program and ensure that it was implemented. If HER was not "working" in their opinion it is doubtful this would have been the case. If these teams had been in place from the start of the research, it is possible pupils may have been able to complete more episodes each week and so progress further through the program. As mentioned previously, teacher feedback indicated technology issues slowed progress, and that some schools didn't have the sufficient number of or availability to iPads; dependence to older PCs/Laptops added up to ten minutes to episode completion. The technical glitches experienced by schools are likely to have come from one of two sources: computer hardware and/or limited internet signal. Decisions on the funding/purchasing of hardware go beyond the remit of this research however it is clear that to harness the most effective educational technology, schools must provide suitable technology for their pupils. It would be unethical for future research to limit future participation to schools with the best technology as this is not indicative of the environment many schools operate within. However, future research may need to consider whether access

to existing equipment is an important variable to consider in evaluations of program efficiency and efficacy.

5.3 Wider implications and limitations

This research showed that HER was very effective in improving literacy performance, and that school staff can successfully implement it, with training and light support. However, it does require appropriate hardware and a suitable internet signal to work at its full potential. Evaluating the longevity of the impact HER had on pupil's literacy was not possible in this research, due to Covid-19 forcing early closure of schools in March 2020. Therefore, it is not known whether the significant impact demonstrated would maintain in the weeks and months following the end of the research. However, the key finding from this research is that HER is an effective intervention for disadvantaged children to close the literacy attainment gap between them and their non-disadvantaged peers. Furthermore, this research has demonstrated that current provision in some schools in Northern Ireland is not effective in closing this gap. Indeed, results would suggest that if current methods endure, the gap between disadvantaged children and their non-disadvantaged peers will maintain and even widen for some. The negative impact of this on individuals, their communities and wider society is well documented.

The fact that that schools were willing and able to implement an effective intervention without the addition of extra resources, or continued, intensive external support is very positive. However, this of course may not be representative of all schools in N. Ireland, so future research should increase the number and location of schools nationwide. The outbreak of the Covid-19 pandemic and the difficult economic environment could be disastrous for schools in terms of increased funding opportunities. However, the current difficult conditions may provide a surprising opportunity for the advancement of evidence-based practice (EBP),

and in particular, CAI in schools. The ability to provide a higher impact on performance with less resources, will be at the forefront of government and educators thinking. However, widespread adoption of new strategies will not happen without a change in culture whereby EBP is accepted as a key facet of all aspects of teaching policy, led by government, endorsed by national and local school authorities, supported by school leadership and embraced by teachers across all UK schools. EBP must supersede "craft knowledge" in the selection and use of instructional method and resources. As with medicine, EBP should become the norm in education. The current disconnect between EBP and teaching methods should be addressed through partnerships that foster collaborative education between schools and research centres. Anecdotal evidence, disseminated via word of mouth, is still a powerful tool in education, particularly since the development of social media and the proliferation of online teacher forums (Green, 2016; Krutka, 2016). This should be harnessed via facilitating research involving schools and letting them disseminate the results to each other in a way that will resonate. Research papers with challenging terminology and difficult to understand statistical analysis will make little impression on busy teachers, already under extreme time constraints. Word of mouth from a respected peer may cut through suspicion of technology and fear of change in a way that data within an academic journal may not.

Creating a suitable research environment is key to the evaluation of existing/novel methods. As with this research, adding to a teacher's workload may be sustainable with goodwill for a period of months, however, robust ongoing research requires commitment and suitable allocation of resources. Teachers need time, in addition to teaching and administrative hours, to participate in effective, ongoing research. If the result is improved performance and indeed "more in less time", then schools are more likely to be willing to participate. In an environment where league tables and performance metrics are becoming the norm, incorporating evidence-based strategies which improve results should be the goal of every

school. To identify what is effective, robust research is key, and collaboration should happen from the top down. It is unlikely a single teacher can change processes within a school, however, that is certainly within the power of principals and educational authorities. Furthermore, teacher training for new and existing teachers must include EBP as a core subject. Teacher's feedback on existing training is lukewarm at best; training is too generic and not subject specific, little is offered in terms of SEN pupils and often, no funding is available to cover a teacher on external training, so often, teachers do not attend. Additionally, there is little evidence of EBT training in the learning curriculum for new teachers. Too often, gaining hands on experience in schools via placement is seen as the most important way of learning how to teach. This must change. A new teacher should be able to bring the best theories and EBP to schools to improve performance, not merely join a continuum of existing methods, many of which appear to be ineffective. Increasing this knowledge base acts in two ways; it removes the fear of new processes by creating a clear picture of what EBP means and empowers new and existing teachers to continuously challenge existing methods while researching more effective ways of teaching. With serious concerns about the upcoming N. Ireland school funding environment, partnership with research centres offer schools the opportunity to develop their knowledge of topics such as EBP and subsequently begin to apply best practice. The most effective drivers for change and continuous improvements in teaching is likely to come from teachers themselves as unfortunately, government has yet to take the lead.

The lack of leadership around the use of EBP is startling. Advice is given by Government on many aspects of financial management and procurement. However, little attention is paid to methods of reviewing evidence-based practice when purchasing educational resources. Similarly, new teacher training offers little in the way of understanding EBP and its potential impact on learning which has resulted in the use of teaching methods that are doing little to

close the literacy attainment gap. Large-scale, sustained improvement in student outcomes requires a sustained effort to change school and classroom practices, not just structures such as governance and accountability. The heart of improvement lies in changing teaching and learning practices in thousands of classrooms, and this requires focused and sustained effort by all parts of the education system and its partners.

Whereas it seemed that the decade of austerity was coming to an end with promises of increased educational funding throughout the UK, the COVID-19 pandemic has suddenly created a worrying uncertainty about all aspects of government funding. The funding challenges that will be faced by government following record falls in UK GDP of 20.4% in the month of April 2020, equivalent to approximately £30billion and record government borrowing of £55.2 billion in May 2020, nine times that of the same month in 2019 (Office for National Statistics, 2020), will be unprecedented. "More for less" is going to be demanded more than ever before. As this study has shown, the use of EBT offers a possible solution; well targeted resources can have important effects even in small amounts for modest outlays. Although research (Teddlie & Reynolds, 2000; Muijs, 2006) suggest the impact of EBP is limited to between 10- 30% of the variance in pupil outcomes, an increase of 30% in performance would make a huge difference in closing the attainment gap, especially in terms of literacy. Furthermore Levin, (2010) argues that "assessing the potential impact of schools on pupil performance may be a bit like assessing the potential benefits of surgery prior to the development of good antiseptic procedures; one would have badly underestimated what was possible with the right practices!" (p374).

5.4 Future direction.

This study was successful in replicating and expanding upon previous research evaluating the potential of HER as a supplementary support for at risk pupils. Study 1 increased the sample size of study participants to 123 pupils across in eight schools, who were each randomly

assigned to a treatment or waiting list control condition. This reduced the possibility of contamination when members of a control group are accidently exposed to treatment condition. Furthermore, this study increased the social and ecological validity of HER by planning for independent use by schools and reducing the need for external expertise. It is hoped that, given the significant results achieved by schools under these conditions, this should increase the willingness of the Department of Education to explore the positive impact on literacy of HER on a larger scale throughout N. Ireland, and to build on the knowledge of this regional study.

The assessments used in a study influence the results obtained. Two assessments were used; a standardised reading test and a bespoke phonics fluency test. Although results were very similar for both, the efficacy of the HER program would be further enhanced by testing pupils in line with milestone tests they receive throughout school. This would also allow evaluation of the longevity of the impact on literacy in the weeks, months and indeed years following intervention. Future studies should also take note of one of the findings of this study regarding the viable number of episodes per week completed, the resources required to apply such interventions and the impact of technology on progress. This will help establish a timeline that reduces impact on teacher time and ensures as high a level of program completion as possible. Additionally, future research should place greater emphasis on pupil selection via analysis of pupil performance indicators to ensure the most suitable pupils are targeted. If the GDPR guidelines are a concern in terms of data protection, school can easily anonymise pupils before reviewing their results with members of a research team in advance of pupil selection.

This research would also indicate that further research into existing literacy interventions used in schools is urgently needed. The cost of existing interventions in terms of purchase price and teacher time cannot be calculated until they have been exhaustively identified and

categorised. Once completed, comparisons can be made with programs such as HER and subsequent decisions on best practice can move from the realms of craft knowledge to that of fact and evidence. Based on the literacy benefit demonstrated in this study, the potential return on investment of use of HER is significant. Therefore, an accurate picture of other interventions currently in use is vital for comparative purposes.

5.5 Summary and conclusion

This body of work has added value to an existing body of evidence on the positive impact that HER can have on children's literacy. It demonstrated significant improvements in literacy performance for children in a HER treatment group in comparison to those in the control group receiving teaching as usual. The novel contribution has come from the increased sample size and use of schools to run the program independently. Furthermore, quantitative analysis has provided important data on the experiences of teachers who used the HER program with existing school resources. This study also provided information on the number of participating schools who stated that they would continue to use HER following the end of the initial research period, thus improving the ecological validity of the program. McLeroy et al, (1988) identified how, when promoting good health, health psychologists have rejected individually orientated behaviour change strategies that hypothesis ill health is due to personal failure; they focus on influencing policy and promoting effective interventions that favour use of an ecological model centred on wider social and environmental causation factors. Educational interventions should mirror this strategy by empowering teachers with knowledge of evidence-based interventions, while concurrently providing the required levels of environmental and social support to facilitate their effective implementation. Empowering teachers to empower pupils is the ultimate aim of education. Systematic phonics training has been repeatedly shown to the most effective method of teaching literacy and this was shown to be the case once again in this study. Yet schools still

employ a combination of methods to tackle literacy difficulties involving both phonics and whole language approaches that ultimately are often not effective for those most in need. It is clear teachers require better informed training, guidance, resources, and support to be able to be most effective and efficient. To truly begin addressing the increasing gap between the better and the worse off in society, research should continue to inform practice, and vice versa. The knowledge gleaned from this collaborative approach between schools and research centres should continually inform teacher training in the theory and application of EBP. This will empower schools and parents to better recognise strategies based in sound scientific principles, and to utilise effective CAI technology to ease the burden on teachers struggling to address barriers to literacy faced by some children in their classrooms. A joined up approach between researchers and schools is key in remediating literacy difficulties, to achieve better educational outcomes, and to increase the overall attainment and aspirations of children most in need.

"The more that you read, the more things you will know. The more you learn, the more places you'll go!!!"

Dr. Seuss.

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Appendix 1

Ulster University Research Ethics Committee Approval

Ethical approval for the Better Reading for Better Outcomes research project was received by Dr. Claire McDowell, Ulster University in December 2018.

Because of the COVID-19 pandemic, the approval documentation is locked in Ulster University and is not currently accessible.

Confirmation of ethical approval is available from Dr. Claire McDowell:

Mail: ce.mcdowell@ulster.ac.uk

Tel: 02870 3230861

Appendix 2-Promotion pack

Improving literacy in children; helping teachers choose effective resources.

Information about the study

Pupils and teachers from your school are invited to take part in a research project that aims to explore low literacy levels in children from disadvantages areas of N. Ireland. The study will also explore how schools choose resources to help meet the educational needs of students and the requirements of the national curriculum.

Why have I been asked to take part?

The schools we are interested in working with must be in the north west of N. Ireland and have a sufficient number of students receiving free school meals.

What does the study involve?

There are four phases of the study:

Phase 1: Research of current methods of teaching literacy.

You will be given a link to provide access to an online survey exploring What *literacy teaching strategies you choose to use in your school and why?*

The answers to these questions will enable the research team to build a picture of the current methods used to teach literacy in primary schools in NI.

Phase 2: Development of an information, training and support resource package. Phase 2 will focus on training teachers in participating schools how to implement, monitor and support the Headsprout computer assisted literacy programme. Headsprout Early Reading provides instruction in Phonemic Awareness, Phonics, Fluency, Vocabulary, and Reading Comprehension, and teaches segmenting, blending, decoding in context, and reading for meaning and enjoyment.

Headsprout adapts to the needs and pace of each individual student and progress depends on mastery of each area. (Please see attached leaflet on Headsprout)

Training will target the use of behavioural supports to maintain motivation and commitment from pupils and staff. Parents will also receive information on how to support their child's learning at home.

Phase 2 will also teach participating teachers how to identify different levels of evidence-based practice in education, what it means, how to check for evidence-based practice and identify teaching methods and resources that may not have an evidence base to support their efficacy as opposed to those that do.

Phase 3: Implementation of the experimental interventions in schools.

With training and support from researchers, each school will introduce the Headsprout© computer assisted literacy programme four times a week for a period of twenty weeks. Each session takes approximately 30 minutes.

A teacher in each school will act as the Headsprout coordinator. This person will receive training on the operation of Headsprout and the general requirements of the programme. This person will liaise with both the student researcher and similar contacts in other participating schools to establish an inter school network promoting best practice and collaboration. It is preferable that this person has a reasonable grasp of I.T. and experience in teaching literacy although this is not essential.

Headsprout is an online programme accessed via the internet. It can be used via Laptop, PC, IPad or Tablet. The licenses will be purchased by the research team. It is used on an individual basis with headphones and requires little involvement from teachers. Students work through each episode then update their books and maps as they progress.

Parental and child consent will be sought from all participants. Children involved must meet the following criteria: be aged between 5-10, receiving free school meals and have identified

literacy difficulties. Family income is known to be linked to children's educational attainment with children from less well-off backgrounds, on average, less likely to achieve literacy targets at school than those from families with higher incomes. Children who meet this criteria will be assessed using standardized reading tests including Phonics Early Reading Assessment (PERA).

Children who demonstrate they are below expected literacy levels for their age will be randomly placed in one of the following two groups:

1. Headsprout Test Group: These children will receive extra teaching four times a week using Headsprout © in addition to existing literacy teaching methods.

2. Control group: These children will continue with existing literacy teaching methods.

Measurement of students will happen before, during and after the project. If effective, the intervention will then be introduced for the children in the control group.

Assessment and intervention will be introduced to two schools at a time.

Schools will be paired with each other based on demographic variable such as percentage free school meals and pupil profiles. This aims to foster positive school to school collaboration throughout this project and beyond.

Phase 4: Analysis and dissemination of results. Results will show if participants in the Headsprout group made greater improvements from pre to post-test on measures of pre-phonics awareness and word/non-word recognition than participants in the waiting-list control group. If so, the children in the waiting group will then receive the Headsprout literacy teaching. A package of support for schools and parents will be developed to ensure that the project endures after the initial research period has finished. This is a key aim of this project. This package will provide the knowledge to allow schools to run the project on an ongoing basis. Phase 4 will also involve disseminating the results to ensure maximum circulation via journal publications, conference presentations and networking.

Are there any benefits or risks?

As well as potentially improving literacy in participating children, there may be an improved understanding of current best practices in the selection of programmes and material for use in schools. This may improve student outcomes and provide better value for money.

There are no known risks relating to participating this study.

What will happen to my data?

All data collected will be confidential. Neither the participating schools or students will be identifiable in any report, thesis, or publication that may arise from this study. The data from this study will be stored securely for five years. If you choose to withdraw from the study, we will dispose of the information collected on your school and not use it in any way.

What if I don't want to take part?

It is up to you to decide whether or not you would like to participate in this study. There are no consequences to deciding that you do not wish to take part. In addition, you can withdraw from the study at any time without giving a reason.

Who are we and who do I contact about the study?

The PhD researcher is Gerry McWilliams from Ulster University. Gerry has just completed his Masters in Applied Behaviour Analysis and has worked in the field of special education for fifteen years.

The chief researcher is Dr. Claire McDowell, BCBA-D. Claire is a Board Certified Analyst Doctoral Designation (BCBA-D) and is a lecturer in Applied Behaviour Analysis. She has taught at pre-degree, degree and post-degree level and has supervised 7 PhD and over 80 MSc students to successful completion.

This approval for this study has been granted by the Ethics committee at Ulster University.

If you have any further questions, please contact any member of the research team:

Gerry McWilliams: mcwilliams-g2@ulster.ac.uk
Claire McDowell: ce.mcdowell@ulster.ac.uk

Who do I contact with any concerns about this study?

If you have any concerns or complaints about this study or the conduct of individuals conducting this study, then please contact Dr Claire McDowell, School of Psychology, Ulster University. 02870 123086

Letter to schools

Dear Principal,

My name is Gerry McWilliams and I am a PhD researcher working on the "Better Reading for Better Outcomes" project. Funded by the Department for Employment under the 'Northern Ireland Programme for Government', this project aims to target literacy levels in children from disadvantaged areas within N. Ireland. Research has shown children who cannot read at the required level are less likely to achieve qualifications and employment. Although general literacy levels are improving, the gap between disadvantaged children and other isn't. This project aims to help close this gap. Better reading for better outcomes will use the online Headsprout© computer assisted instruction programme to target and improve literacy in children (See attached Headsprout Information sheet). Pupils who have been identified as having literacy issues will participate in 80 literacy lesson to complement existing literacy teaching in school via 4, 30 minute online lessons per week. Testing will be carried out before, during and after the project to determine the effectiveness of using Headsprout to improve literacy. Additionally, Better Reading for Better Outcomes aims to support teachers in the use of evidence-based practice and its impacts on the selection of teaching methods and materials. This will involve questionnaires, interviews and staff training to help staff understand what evidence-based practice means and have the confidence to apply this knowledge in their day to day decision making.

I am inviting you to consider joining this project. I have attached further information and an expression of interest form that can be return to us at the address provided. The expression of interest is not a commitment to participate, just a request for further information at this stage.

Please do not hesitate to contact us with any questions you may have and I thank you for your time and consideration.

Yours faithfully,

Gerry McWilliams
PhD Researcher
Ulster University

Mail: mcwilliams-g2@ulster.ac.uk

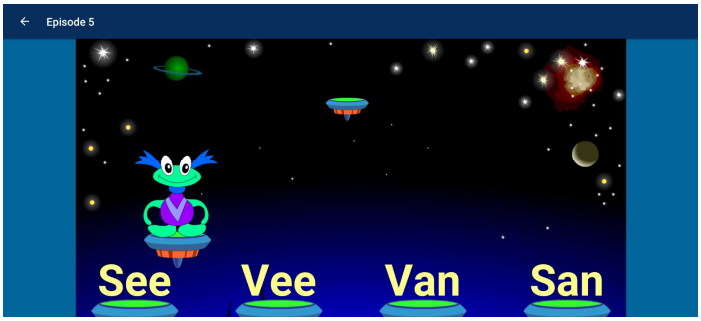
Dr Claire McDowell, BCBA-D
Chief Investigator
Ulster University

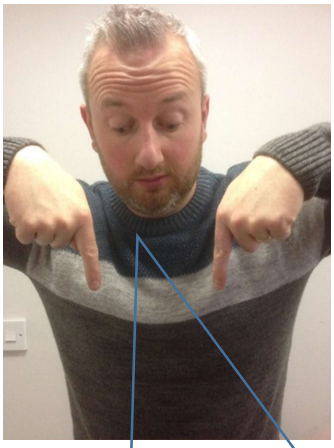
ce.mcdowell@ulster.ac.uk

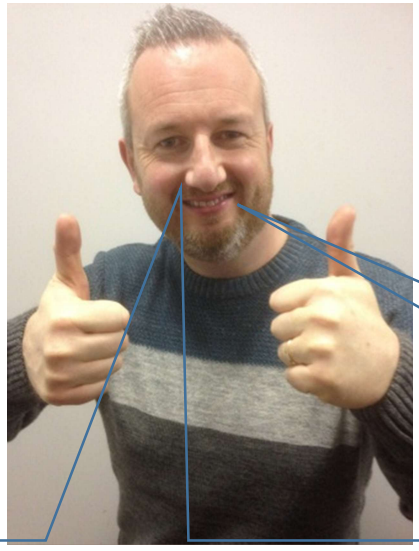
Pupil Information sheet

Hello! My name is Gerry and I am going to try and help children read better by using a computer programme called Headsprout!

Headsprout uses cartoons, games and puzzles to teach you letters and words!







We would use it four times a week for 30 minutes. We will practice reading before you use Headsprout to see how you are getting on. We will then practice again during and after to see if it's helping you!

You don't have to join if you don't want to and you can leave anytime you want.

Would you like to Join?

If yes, fill your name on the back of this sheet and give it to your teacher. Thanks!!

Parent/Guardian information sheet

Hello! My name is Gerry McWilliams and I am conducting a PhD research project investigating if computer programs designed to help children learn many of the basic skills required to read are effective.

'**Headsprout Early Reading'** is a reading program delivered via the internet. This program is highly engaging and so makes learning to read interesting for children. Each 20 minute lesson is an "episode" in cartoon format where fun characters and animals help children learn to read in places like undersea world, dinosaur world, space world and jungle world. Headsprout is individualised to each pupil in that the program automatically records the number of mistakes made in each episode and will re-present some of the material in the next episode if a child has struggled with it.

What does the study involve?

We are interested in seeing how effective this program is for children currently attending school who would benefit from extra reading support. If your child were to participate in the study, their current reading ability would be assessed using a reading test before they begin using Headsprout. When all children participating have been assessed, each child will be randomly allocated to the either the Headsprout Early Reading group or a waiting control group. Children allocated to the Headsprout Early Reading group will immediately begin their programs, completing 4 lessons each week. All children will continue to have their normal reading lessons as well.

Each child will be tested weekly on the commonly encountered words and sounds. Once they have completed the full 80 lessons in their program, their reading skills will be reassessed using the reading test to determine if any change in their reading ability has occurred. It is estimated that the study will take approximately 25 weeks in order to allow children to complete the majority of lessons in the Headsprout program.

Children will be supported at school by a coordinator who will be supported to run the programme by myself and another researcher.

When children in the Headsprout group have completed the program, and if data indicates it has been beneficial, the school will begin using the program with the children in the control group.

Are there any risks or benefits?

There are no known risks of using the program indicated by the research that has been carried out to this point. Benefits of using the program may be an improvement in reading skills and phonic awareness for those children who participate.

What will happen to the data obtained?

Data from this study will be used as part of a PhD project. However, all data will be confidential and children will not be identifiable whatsoever through any thesis, presentation, assessment or publication. All children will have their names changed to a code to ensure they remain anonymous. The data will be securely stored for 10 years following the end of the study in the Chief Investigator's office, in a locked filing cabinet and on a password protected computer, before being destroyed. The child's parent/guardian can receive progress reports or discuss any issues or concerns at any stage throughout the study by contacting the student or chief investigator.

What if I, or my child no longer wishes to take part?

There is no obligation for the parent/guardian to consent to their child taking part. Likewise the child can leave the study without reason at the parent/guardians request. Simply contact either of the researchers listed. Any data obtained up to that point will be securely destroyed.

Who do I contact if I need more information or have concerns?

If you have any questions or concerns, please do not hesitate to contact either the student researcher or chief investigator.

Student Investigator: Gerry McWilliams mcwilliams-g2@ulster.ac.uk 02870 323086

Chief Investigator: Dr. Claire McDowell ce.mcdowell@ulster.ac.uk 02870 323086

For more information regarding Headsprout please see:

https://www.headsprout.com/main/ViewPage/name/product-overview/

Thank you for your time and consideration.

Gerry & Claire.

Better Reading for Better Outcomes

Name of Chief Investigator: Dr. Claire McDowell.

Name of Student Investigator: Gerry McWilliams

Please check to confirm, (X)

( ) I confirm that the researcher has given me sufficient information describing this research. I have read it and had ample opportunity to ask the necessary questions relating to this research and I have full understanding of what this involves for my school's participation.

( ) I understand that pupil's participation is on a voluntary basis and that they can withdraw from this study without offering reason at any point.

( ) I understand that personal information will remain confidential with raw data stored securely by Ulster University's 10 years following completion of the study. I also understand that pupil's personal details are available only to the chief and student investigators.

( ) I understand how to access information regarding pupil's progress if I want/require this information.

( ) I agree for my school to participate in the above study.

Name of School……..:……**Date:……**

Name of School Principal:…… …….. .....Date……

Name of Researcher:…….Date:……

Researcher Signature……Date……..

Consent from (Please send this to)

Gerry McWilliams

Room 101

School of Psychology

Ulster University

Cromore Road

Coleraine

BT52 1SA

Parent Consent Form

Name of Chief Investigator:Dr. Claire McDowell.

Name of Student Investigator: Gerry McWilliams

Please check to confirm, (X)

( ) I confirm that the researcher has given me an information sheet describing this research. I have read it and had ample opportunity to ask the necessary questions relating to this research and I have full understanding of what this involves for my child's participation.

( ) I understand that my child's participation is on a voluntary basis and that I can withdraw them from this study without offering reason at any point.

( ) I understand that personal information will remain confidential with raw data stored securely for Ulster University's required 10 years following completion of the study. I also understand that my child's personal details are available only to the chief and student investigators.

( ) I understand how to access information regarding my child's progress if I want/require this information.

( ) I agree for my child to participate in the above study.

Name of Pupil……..:……..**Date:……**

Parent/Guardian Signature:…… ……. .....Date…….

Name of Researcher:……..Date:……

Researcher Signature……Date……..

Pupil Consent Form

Our Study: Better Reading for Better Outcomes

Chief Investigator: Dr. Claire McDowell
Student Investigator: Gerry McWilliams

This study is to see if we can help pupils read better using a computer program.

If the following sentences are true please tick √ each one (Ask for help if you need it!)

I was told all about the study ☐

I got answers to questions I had ☐

I know I can stop being in the study if I want to at anytime ☐

I would like to be part of the project ☐

or

I would not like to be part of the project ☐

My Name (Printed)……. Date: ……

My Signature:……..

Reseacher's Name …… Date: ……

Reseacher's Signature ……..

Better Reading for Better Outcomes

I, _____ (Principal Name) am interesting in

_____ (School Name & Address) being part of this project.

I understand this is not a commitment to participate, just a request for more information.

Complete your contact details and I will be in touch with more information:

Principal name:

School Name:

School Address:

E-mail:

Phone Number:

Expression of Interest form (Please send this to)

Gerry McWilliams

Room 101

School of Psychology

Ulster University

Cromore Road

Coleraine

BT52 1SA

Alternatively, you can e-mail me directly at mcwilliams-g2@ulster.ac.uk to express your interest at being part of this project.

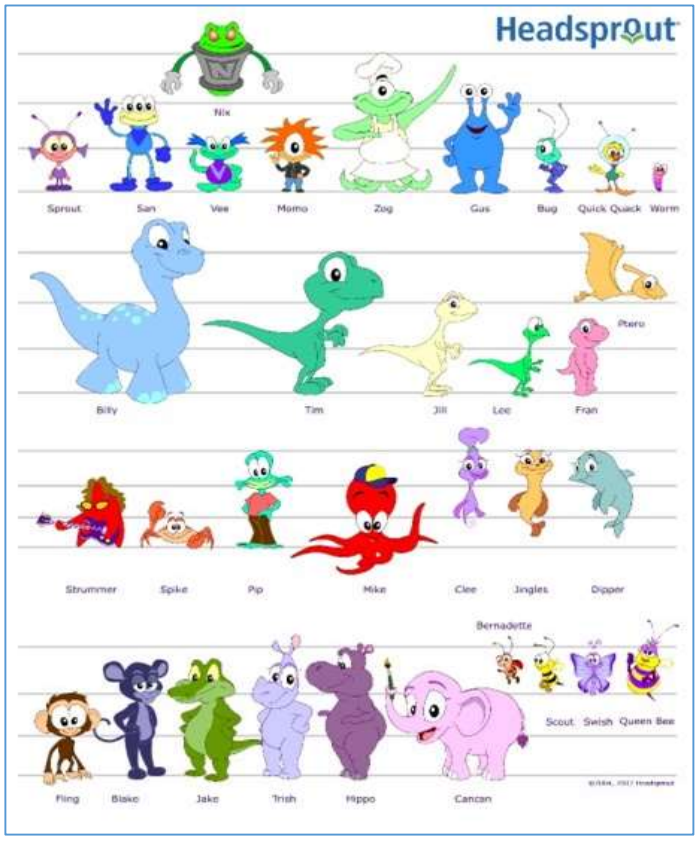
Many thanks for your time.

Gerry.

Appendix 3-HER User Manual

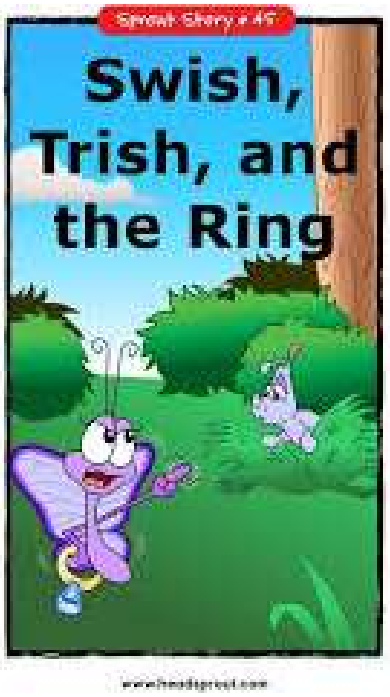
Instruction Manual

Welcome to Headsprout! This guide is designed to help you discover the many features of Headsprout and ensure you have the confidence and competence to run the programme effectively with your students.



Index:

Introduction to Headsprout



Headsprout Early Reading (HER) is an online, systematic phonics programme that uses learning principles to teach the five sub skills needed to become an independent reader. Student are taught phonemic awareness through following the adventures of various characters in four worlds: Sea World, Dinosaur word, Space world and Underwater world.

HER teaches accuracy, speed, fluency, guided learning and provides step by step, individual instruction and practice tailored to the individual. The programme responds to the answers of each individual students and adapts to their specific needs throughout. It is fun, colourful, musical and enjoyable way to learn for students with lots of interaction, speaking out loud, rewards, reinforcement and guided learning.

Students are assessed throughout the programme as well as at specific intervals (every 10 episodes).

Headsprout aims to ensure that each learner completes each episode to 90% accuracy before progressing to the next episode. Information learn in previous episodes is revisited throughout the programme.

The programme becomes more challenging as the student progresses. Longer words and sentences are used and sentence comprehension is introduced.

Upon completion of the 30 hour programme, successful students can expect to be able to decode up to 5000 words.

Headsprout adapt to the performance of each individual learner. If they are not successful in a cert

Before the program begins:

Before you begin using Headsprout with your students you should gather the necessary resources required and check their suitability.

Computer:

Headsprout will work on any of the following:

- Windows Laptop or PC
- I-Pad
- Android Tablet.

Please note for the I-pad and Android tablets it will need to be downloaded for free from the app store/google play.

Sprout cards:

Printed cards to test student learning

Fluency materials:

Printed sheets to test speed and accuracy.

Headphones:

Headsprout works on a 1-1 basis and instructs each student based on their individual performance therefore headphones are required. We suggest having spare headphones as they can break easily. Headphones from the pound shop are fine!

Timer: (stopwatch on your phone is fine)

To test the speed at which a learner can read in certain time periods e.g. 1 minute.

Learners needs to be able to:

- repeat out loud sounds and words that are modelled to them
- self-initiate speech – typically communicating using at least 3 word sentences
- select items when asked. For example, when asked “give me the shoe”, the learner can select a picture of a shoe
- match words and sentences to corresponding pictures
- follow simple instructions (1 or 2 step verbal instructions)
- sit for short periods of time (up to 15 minutes, at least 5 minutes)
- respond to feedback (praise and error correction)

Ability to use a mouse:

Google “mousing around” for mouse exercises. This allows students to practice using a mouse to click and select from different exercises.

Student Ring binder:

We recommend that each student has a Headsprout ring binder which can be used to store printed stories, progress maps, exercises, assessments and anything else to do with the program. They can bring it with them each time they are doing an episode which allows them to update their material immediately upon completion which will help with reinforcing their learning immediately. We also recommend that the teacher/coordinator keep an overall folder with a specific section for each participating pupil to allow them to keep overall information on the progress each pupil is making.

Running the programme:

We suggest a **30 minute slot** is allocated each day for student to do 1 Headsprout Activity, 4 times per week. This will allow set up time and any paper work to be completed each day (Note: there is little paperwork with this programme, most of the information is stored online) and allow each student to work at their own pace which is an important part of the programme.

We do not recommend doing Headsprout at the end of the day or just before break times if possible as it can be more difficult to concentrate at these time.

Move the keyboard away as it is not needed with Headsprout. All work is carried out using the mouse.

Motivation: Make a big fuss of those who are doing it! Have charts on the wall, offer rewards for completing episodes, bring student to the Principal for a “well done” here and there. If students find it difficult to complete and episode in one sitting then its ok to break it into two ten minute slots- Note-There is no PAUSE button on Headsprout, simply allow the student to mute or take headphones off and return when ready to continue.

Headsprout contains an individual **progress map** which learners fill in as they progress through the programme. Use this as a reward/well done occasion for all students to recognise their and others success. There are **STARS** allocated for completion of episodes which allow the learner to build robots and rocket ships, use these to maintain motivation.

Celebrate progress and success throughout and be creative in how you do so!

Rewards and Preference Assessment

It is a great idea to reward student for progressing through Headsprout. Although there are inbuilt rewards in the form of Raz Robot, certificates and many vocal rewards, an additional classroom reward system can be an invaluable tool to maintain performance and motivations. Don't assume what rewards each student would like for completing parts of the programme, instead do a preference assessment for each student. Ask them what they like, ask their parents how they spend their free time and what acts as a big reward in their life e.g. Computer games, YouTube access, Netflix, trips, certain foods, clothes, books-it may be different for each student and if you get the reward wrong, it may impact on their motivation to work. Maybe create a reward chart for each student based on their individual wants and use it as they progress through the programme. Change and vary the rewards and have different level awards for completing 1 episode, 10 episodes, 40 episodes etc.

You may want to use a token economy whereby students receive a token for each episode complete to the required standard. A certain number of token will get the student a certain reward.

Make sure the bar isn't set too high or too far away i.e. don't reward only after 40 episodes with zero mistakes, make it achievable. To get the system up and running you may want to make it very easy to get rewards and/or tokens at the beginning.

Correction Procedure

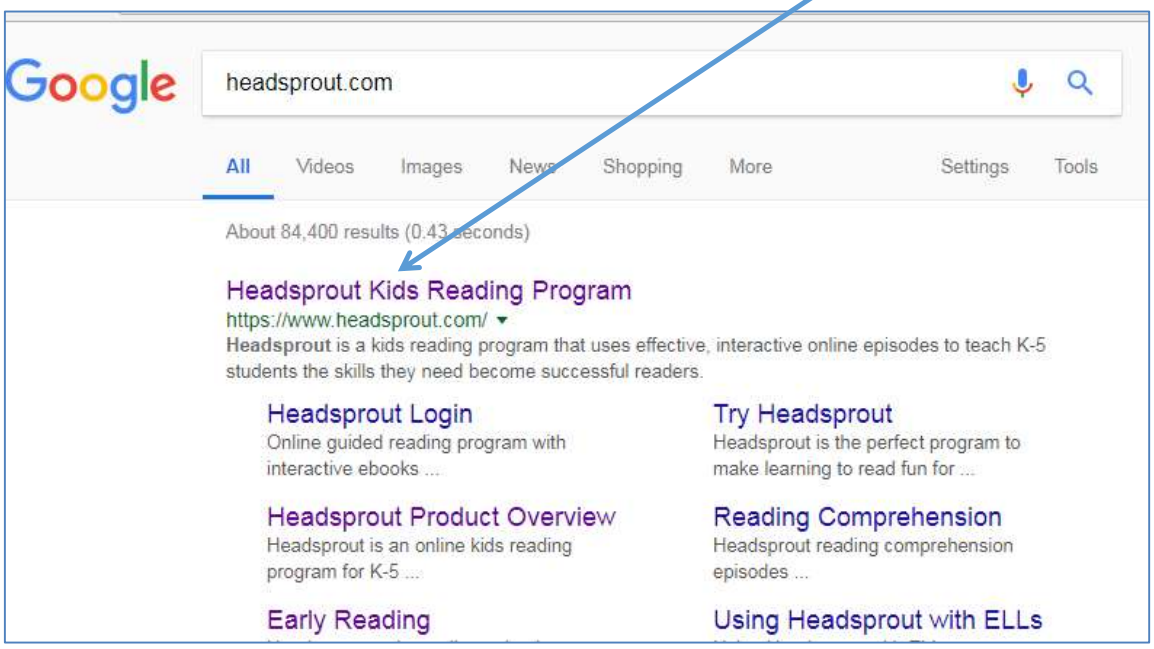
Remember, Headsprout has inbuilt correction mechanisms based on pupil performance. Let the program do the work! Monitor the reading out loud parts of the program. If a pupil is unable to read a word, ask them to sound it out from left to right. If they cannot, sound it out for them and ask them to repeat it with you. Then have them do it on their own. It may be a good idea to note any letters/words a pupil struggles with. You can then refer back to the appropriate episode within Headsprout and have the pupil repeat that episode if needed. Headsprout will do the teaching, you role is to ensure the pupils stay on task.

Off task behaviour

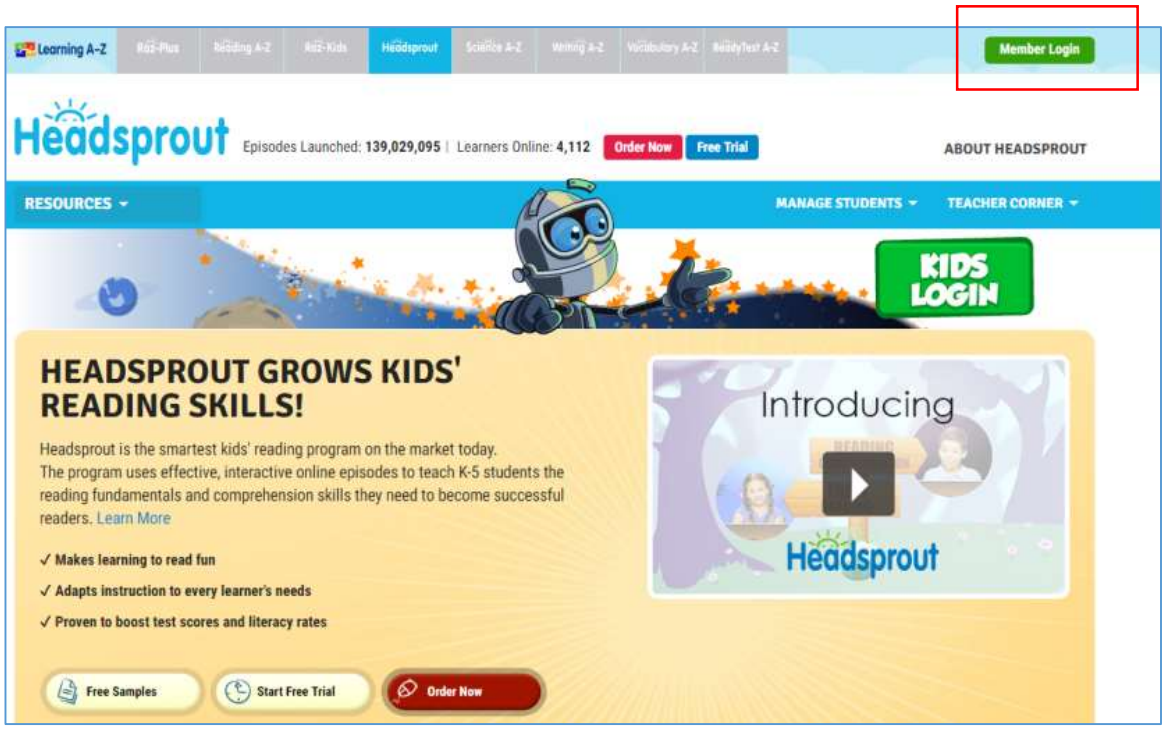
Make a note of the type of behaviour that concern you while they are working on Headsprout. Look for patterns such as hunger, tiredness at certain times of day, who they are sitting beside etc and act accordingly. If they are having difficulty they may show off task behaviour, in this situation a bit of 1-1 time on the programme may help to refocus the student. Praise every correct answer to boost their confidence if they are struggling. If required, break an episode into 2 sitting of 10 minutes each with a break in the middle.

Section 1: Teacher login and first steps.

Step 1 Open Google Chrome and type Headsprout.com and press enter. It will bring you to this screen. Left click on Headsprout Kids Reading Program.



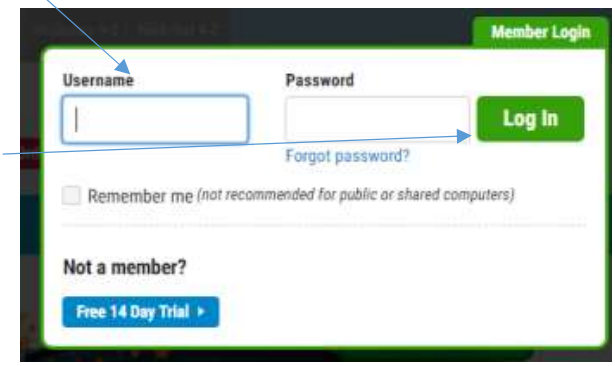
That will open the main Headsprout page. Click on the member login button



You will be asked for your username and password.

Gerry will provide each of you with this.

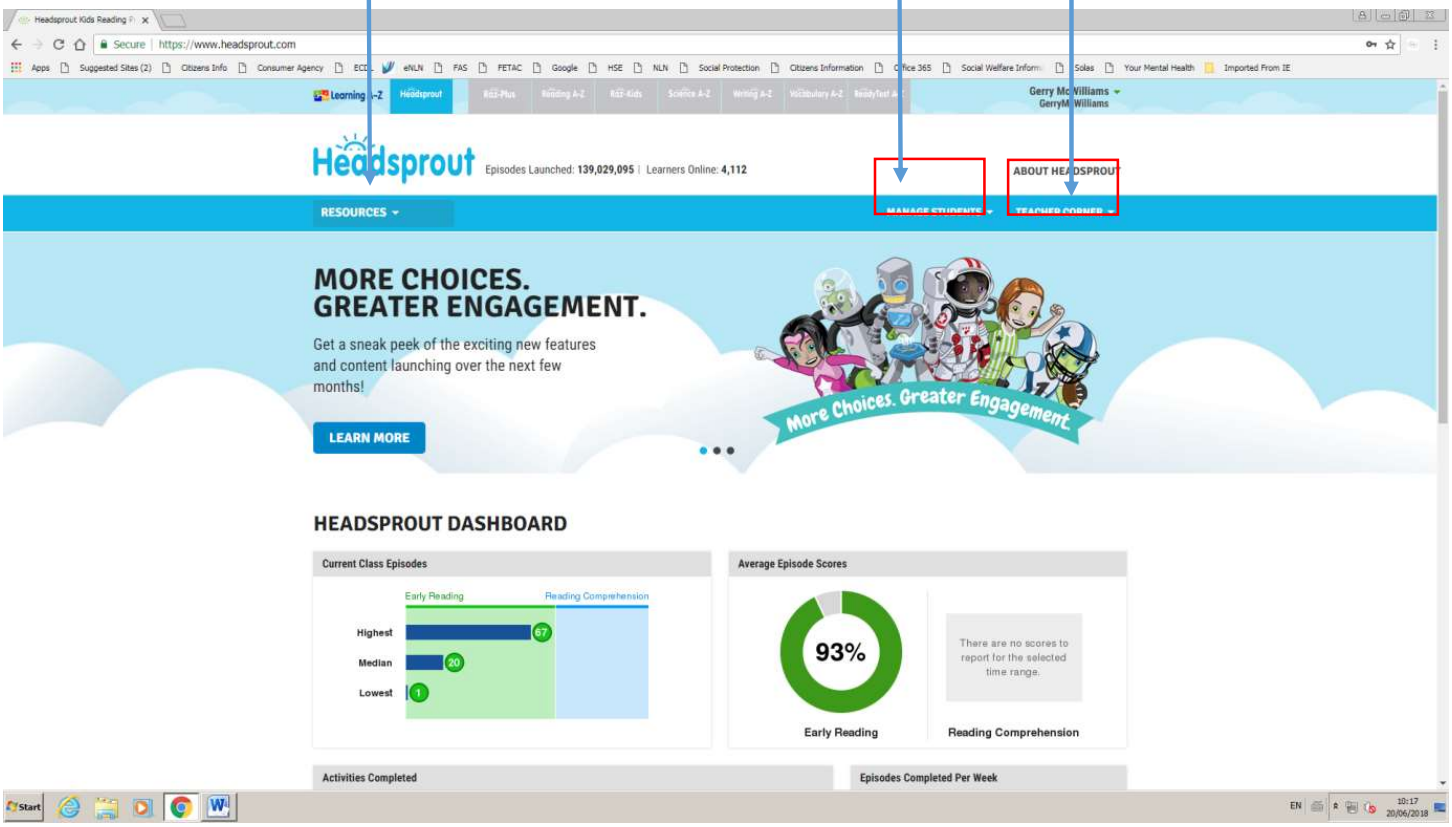
Enter your details and click the green login button.



This will bring you to the **Teachers page**.

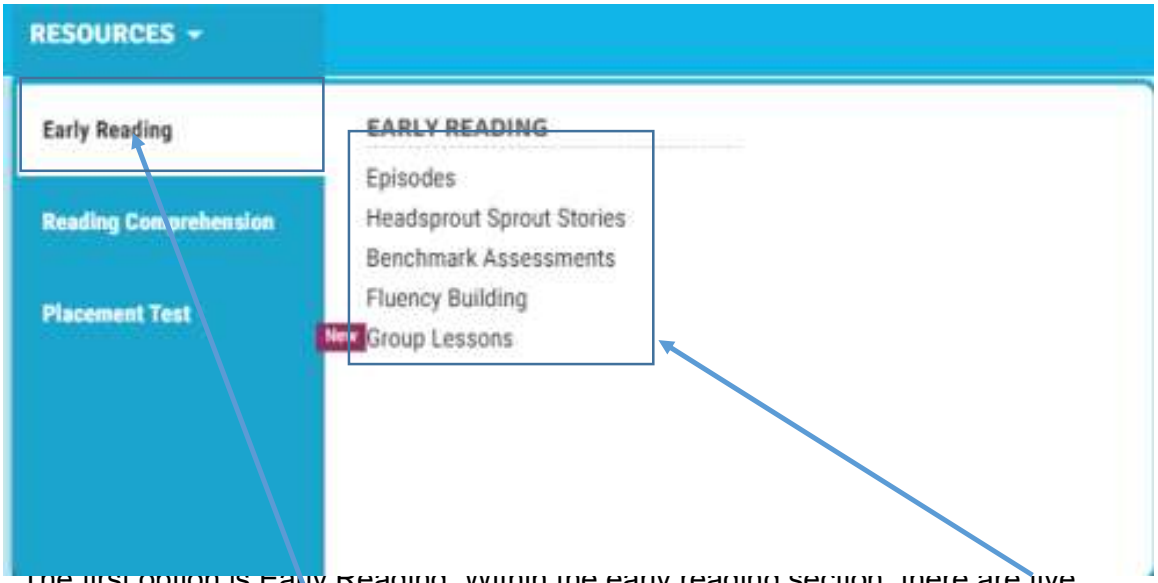
This page gives you general information about how the class grooup are performing overall i.e. average episode score, total number of episodes completed. There are 3 areas from here that you need to access:

1. Resources
2. Manage Students and
3. Teacher Corner



Section1: Resources

When you hover over the resources section a small screen appears.



The first option is Early Reading. Within the early reading section, there are five areas: Episodes, Headsprout Sprout Stories, Benchmark Assessments, Fluency Building and Group Lessons.

Episodes:

This section contains an extensive outline of the content of each lesson from 1-80 including phonomic elements and words taught, flashcards to be used with students as awell as an overview of each section of the program. This is a really good section to look over before running the programme as it will tell you exactly what is being taught at each point. You also have the option of printing Flascards from here that you can use to check and reinforce learning throughout the programme.

Headsprout Stories:

With the 80 episodes of Headsprout there are an additional 90 illustrated books to reinforce what each student has learn in each episode. These can either be read online or printed out, read and kept for practice in each student's Headsprout folder. These books are entirely decodable when students reach the corresponding book: the book contains sight words taught in the online episodes and decodable words made of phonemes taught in the online episodes. Remember to correct any errors immediately and practice after with flashcards if necessary.

Benchmark Assessments

Benchmark assessments help teachers measure student progress and reading skills, and informs them when an intervention may be needed for a student who is

struggling. Benchmark assessments are given to students after blocks of 10 episodes such as after episode 10, 20, 30, 40 etc.

How to do Benchmark assessments:

Print out the relevent Benchmark Sprout story (i.e. 10, 20, 30 etc) from

Resources: Early Reading: Headsprout Sprout Stories

and have the student read it to you.

As they do, mark the relevent benchmark assessment obtained from:

Resources: Early Reading: Benchmark assessment

This should only take a minute or so per child and is based on the following criteria:

- Independent (Firm reading, few errors, little assistance needed)
- Satisfactory – some errors/hesitations, but mostly correct with little assistance needed
- Needs Practice – many errors, not applying strategies, assistance required

Student who need more practice should have 1-1 time with the tutor practicing each sound that they struggled with.

There is another option to voice record each student and mark according to that. We will not be using this function as part of this study so marking by listening is sufficient.

Noting each student benchmark scores:

When you have completed the assessment you will go to “In Basket” section under the Manage Student box and click on Enter benchmark scores then you will enter the score for each individual student. *(Gerry will do this with you the first time to ensure you know how.)*

Headsprout

Benchmark Assessment Tracker

Directions

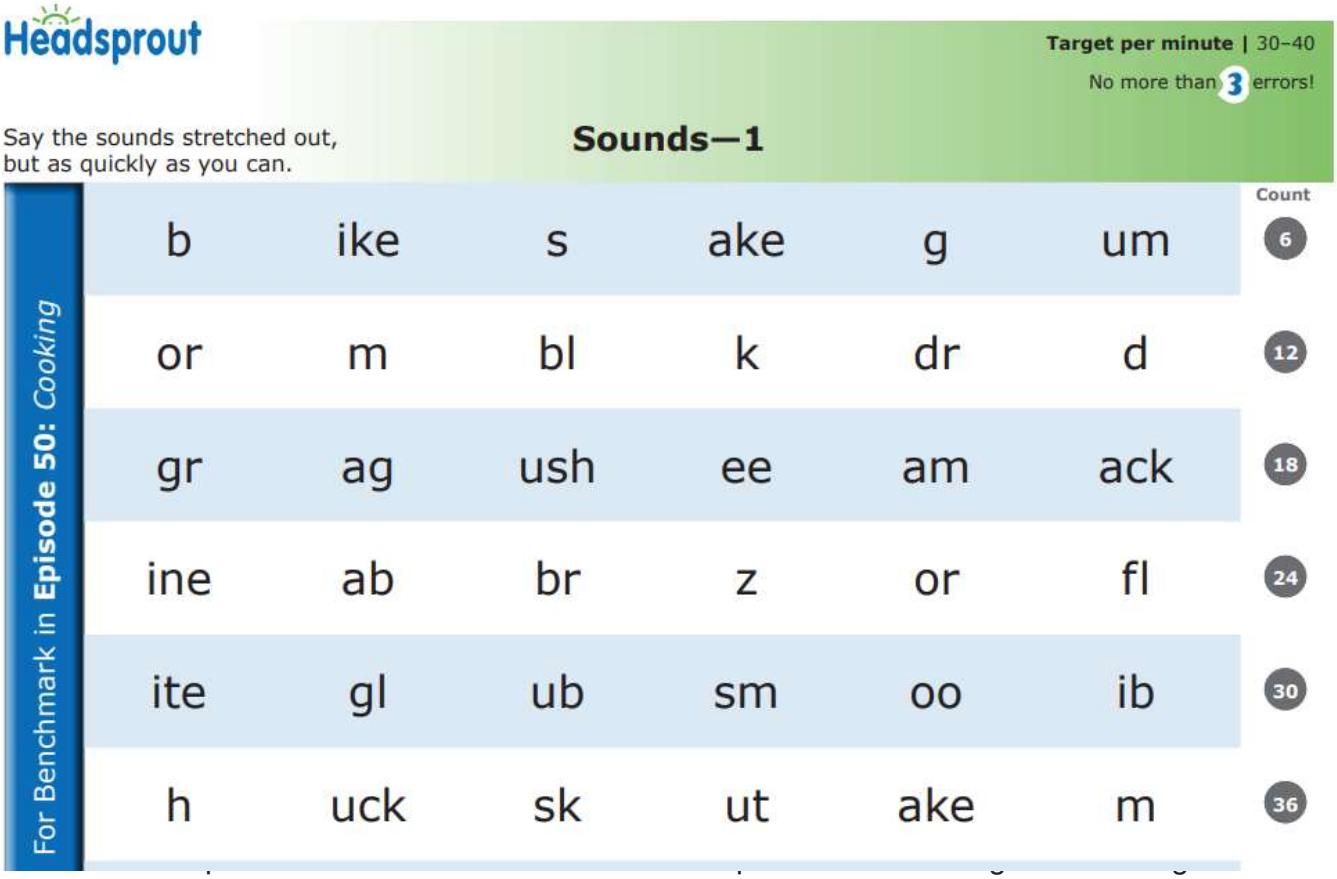
Print the corresponding Benchmark Sprout Story and have the student read it aloud while you track the student's reading on this form (you may have the student read the story online instead of printing it). Find the number of words read correctly by subtracting any errors or omissions from the total number of words. Give the student one of these ratings:

I – independent: firm, few errors **S** – satisfactory: some errors/hesitation **N** – needs practice: many errors

	Episode 10 **Can Fran See?** 27 words	Lee can see the fan. Can Fran see the fan? Fran can see the fan. Lee can see Fran. Can Fran see Lee? Fran can see Lee.	Correct words: ____/ 27 **Rating** ❑ independent ❑ satisfactory ❑ needs practice
	Episode 20 **The Peel and the Fan** 31 words	Vee sees San. Vee sees the fan. Vee sees the peel. The fan flips the peel. Can San see the peel? Vee shouts, "San!" San slips. I see Vee and San.	Correct words: ____/ 31 **Rating** ❑ independent ❑ satisfactory ❑ needs practice
	Episode 30 **Fling and Scout** 41 words	The peel is old. Fling sees the old peel. "I can fling the old peel." Can Scout see the old peel? Can Scout free his wing? Fling can plan. Fling can free the wing. Fling holds the peel. Scout is free!	Correct words: ____/ 41 **Rating** ❑ independent ❑ satisfactory ❑ needs practice
	Episode 40 **Snipping the Strings** 55 words	Clee holds the string. The string holds the ship. Pip holds the string. The string holds the ship. Clee and Pip hold the strings. The strings hold the ships. "I can snip the string." "I can snip the string." Clee and Pip snip the strings. The ships vanish! Can Clee and Pip see the ships? *[STOP HERE]*	Correct words: ____/ 55 **Rating** ❑ independent ❑ satisfactory ❑ needs practice
	Episode 50 **Cooking** 57 words	Fran holds the spoon. She likes cooking. Fran is cooking. Lee looks in. "Come in, Lee!" Zoom! Lee is in! Lee and Fran are cooking. He and she like cooking. Lee holds a book for Fran. Fran likes the book. Would Lee like the book or the spoon? The spoon looks good. "I would like the spoon!" *[STOP HERE]*	Correct words: ____/ 57 **Rating** ❑ independent ❑ satisfactory ❑ needs practice
	Episode 60 **Fling Hides the Plate**	Trish has some cake. She needs a plate. Fling sees Trish, and he sees a plate. "I can hide the plate." Fling hides the plate. The tree has the plate. Swish and Scout see Fling hide the plate. "We can see the plate, Fling!"	Correct words: ____/ 67 **Rating** ❑ independent ❑ satisfactory

Fluency Building

Fluency (speed and accuracy of reading) building is a group of printable or projectable activities where students can do timed readings of sounds, words, and connected text. During one-minute stints, students are challenged to meet specific targets (for example, reading 30 words in one minute) to help improve fluency. These are based around blocks of 10 episodes learning.



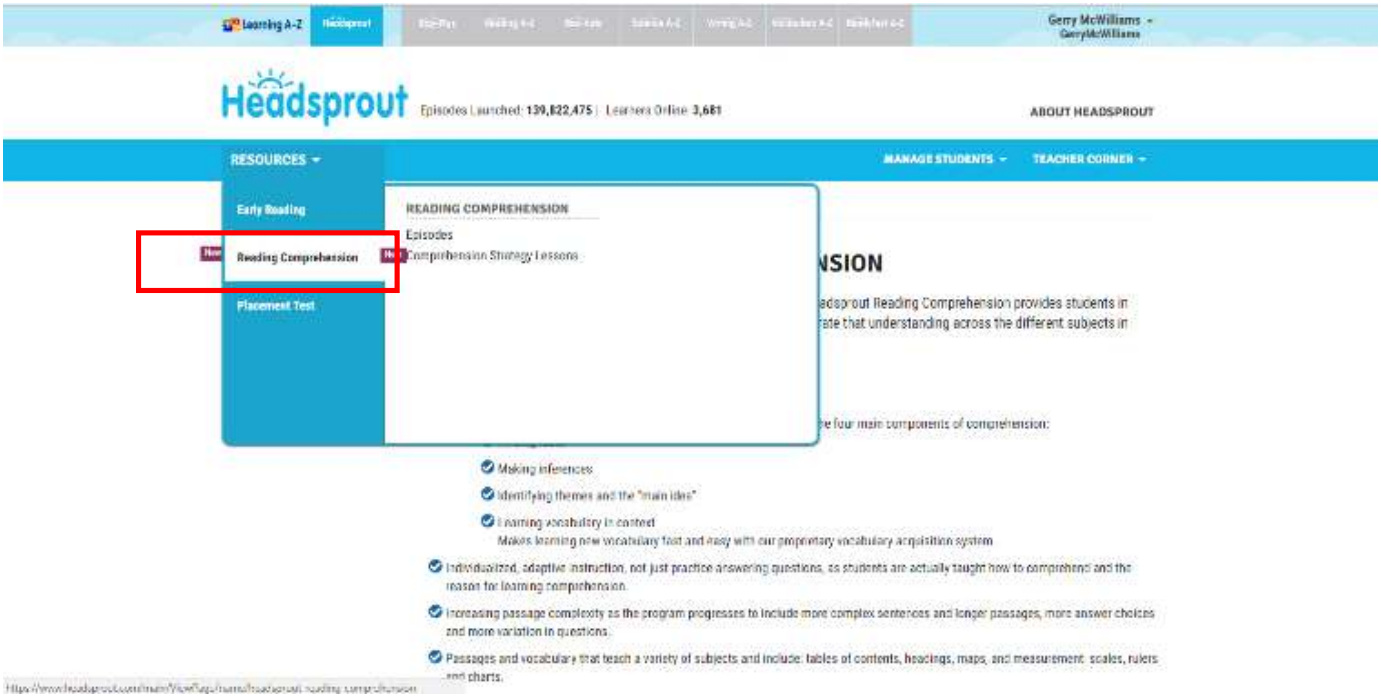
and extend the early reading skills that students learn in the Headsprout online episodes. This section contains detailed lesson plans, student materials and materials that can be projected and taught to a group. It also encourages reading sounds, words, and stories in the context of pair work and group games. Have a look through the materials and see the wealth of resources that are provided.

Reading Comprehension.

The second sections within ”Resources” is reading comprehension.

Note**********

Reading comprehension is a follow up programe to the one being used in this project. It is not being used within this study.



It is intended to be used only when pupils have completed the Headsprout phonics program and focuses on 4 keys ares of comprehension:

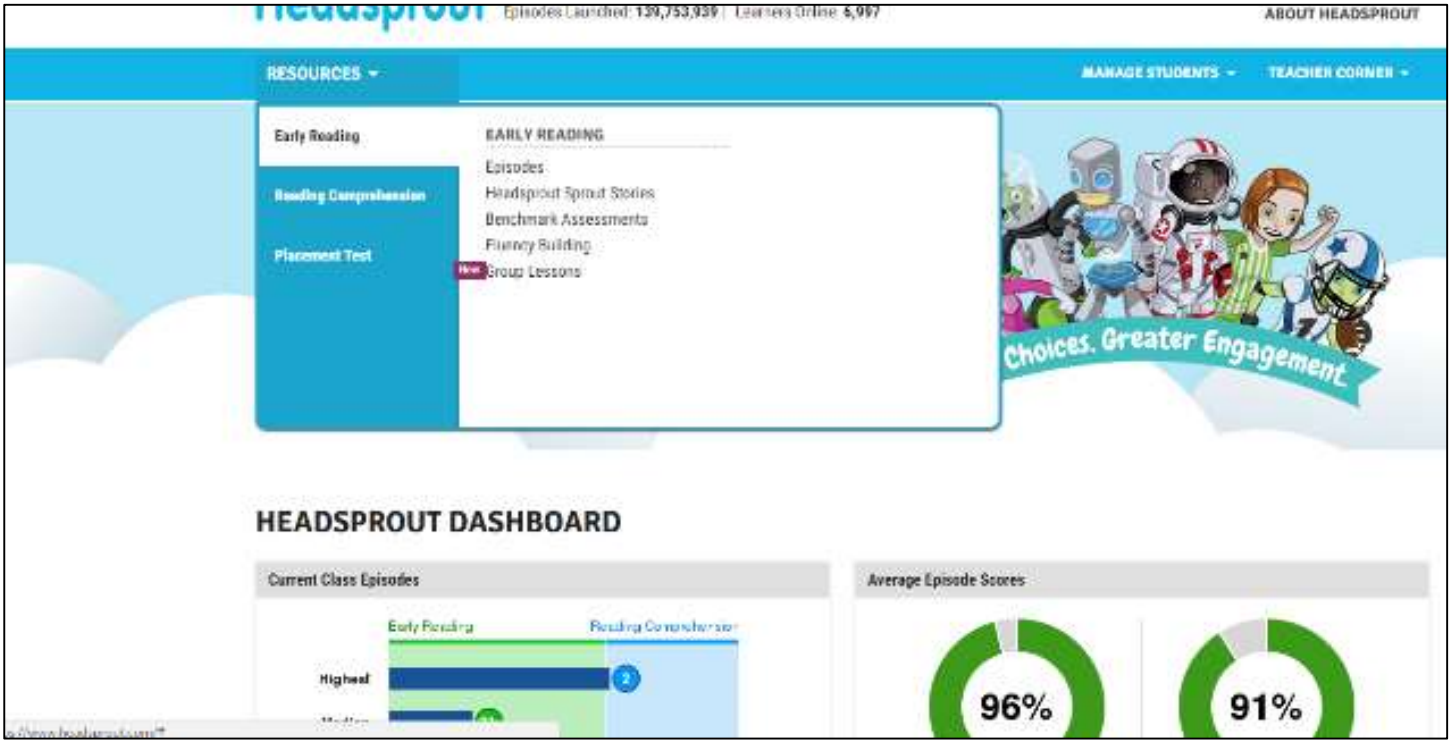
- Finding facts
- Making inferences
- Identifying themes and the “main idea”
- Learning vocabulary in context

For more information about the Headsprout Comprehension Program talk to Gerry.

Placement test.

The last area within the Resources section is the Placement test.

The Placement Test assesses reading skills and recommends an appropriate entry point in the sequence of 80 episodes. Any student who is new to Headsprout automatically goes through the Placement Test online when they first begin the program.



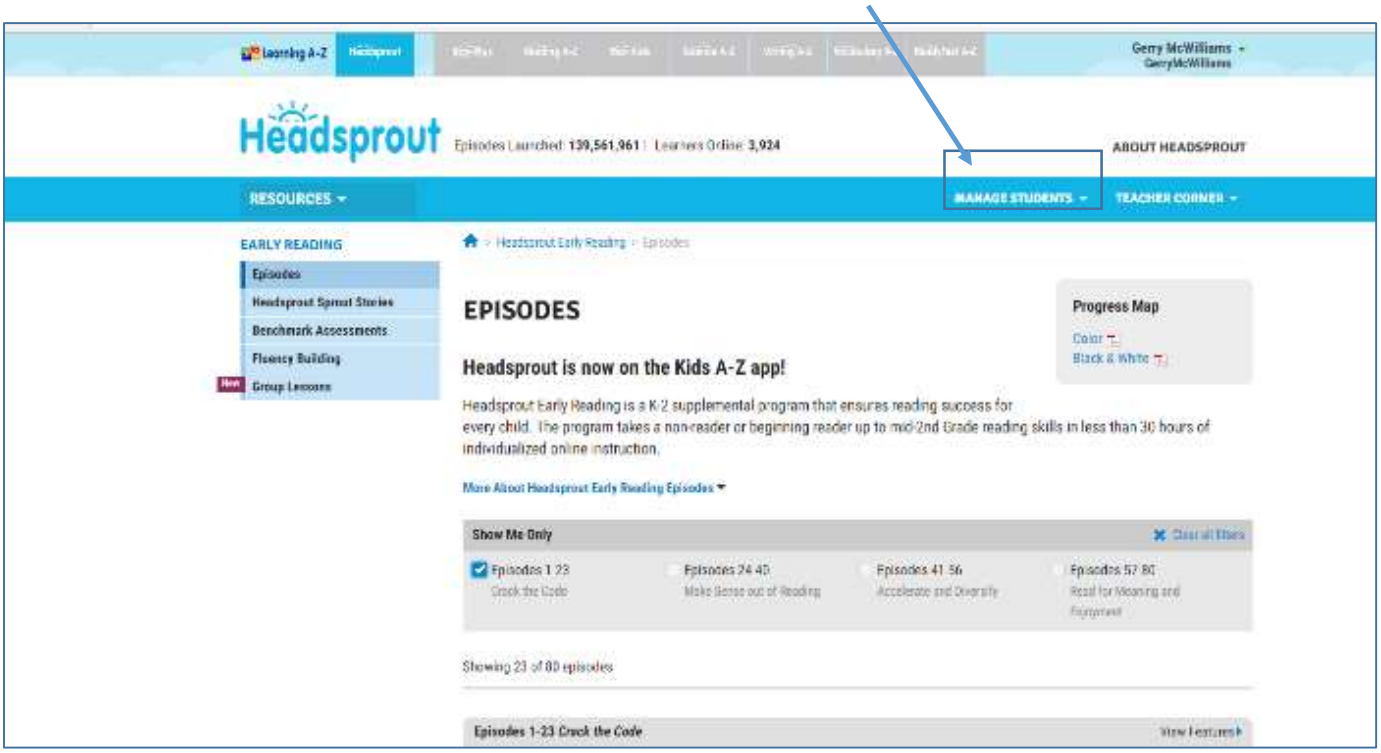
Once the Placement Test has been completed, the student is directed to the episode where he or she placed and is able to begin using Headsprout right away. In addition to taking the Placement Test when they first begin the program, students can retake the Placement Test at any time if the teacher assigns it to them.

For the purposes of this research project we ask that all pupils begin Headsprout at Episode 1 to ensure consistent and accurate results. Additionally, it may be assumed that some pupils may already know these sounds where in fact they may not. Each pupil will benefit from completing Headsprout in its entirety.

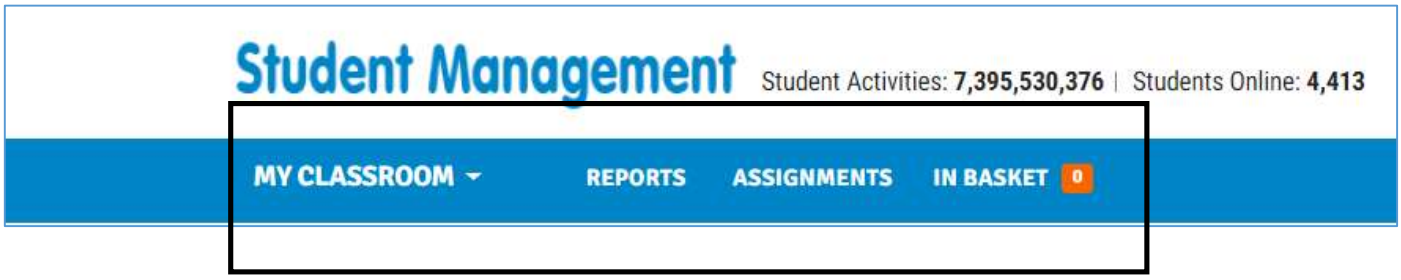
Section 2: Manage Students

The second section of Headsprout is Manage Students.

The manage student section allows you to see who is in your class, add students, restore students and look at individual reports and progress.

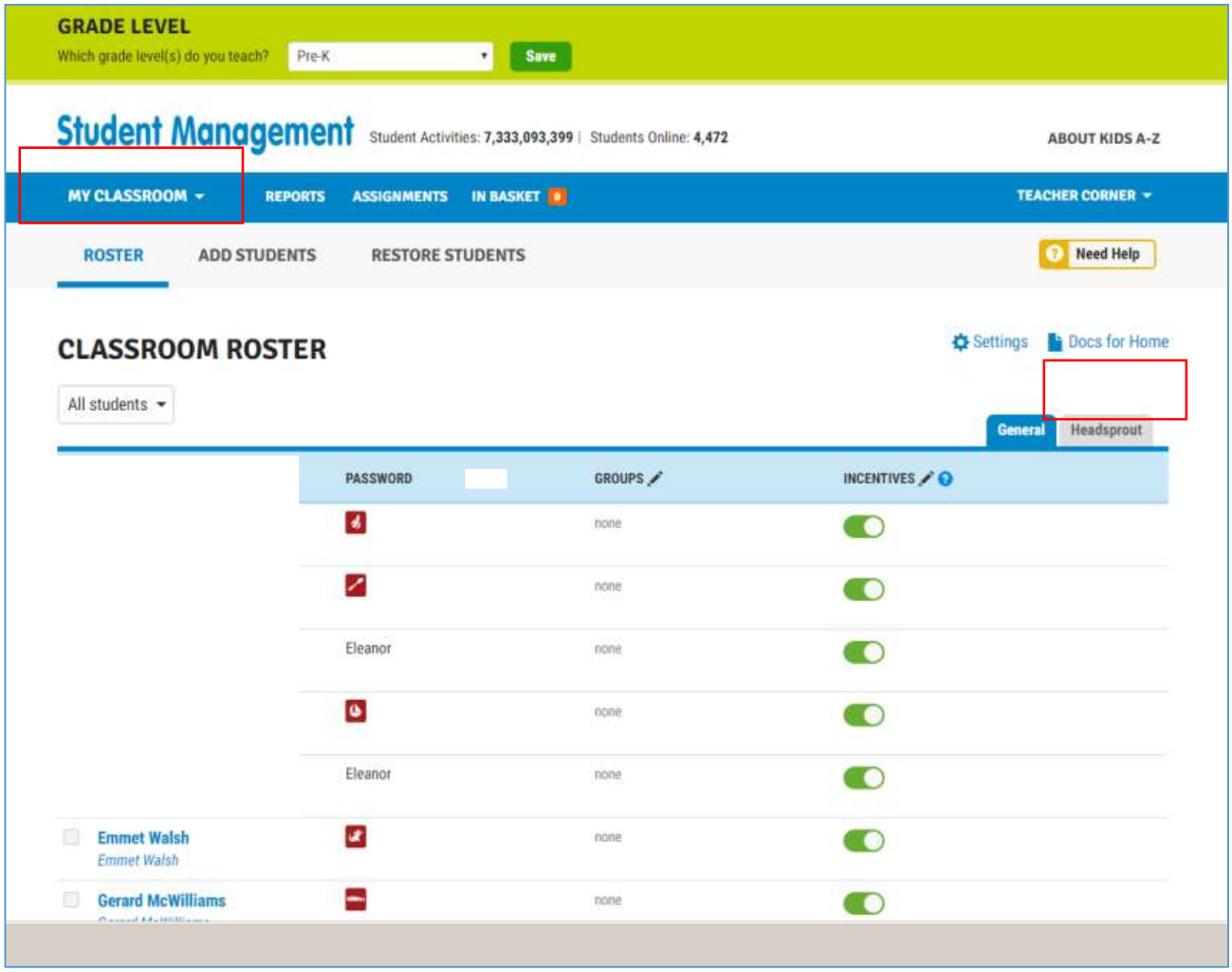


There are four areas of Manage Students section:



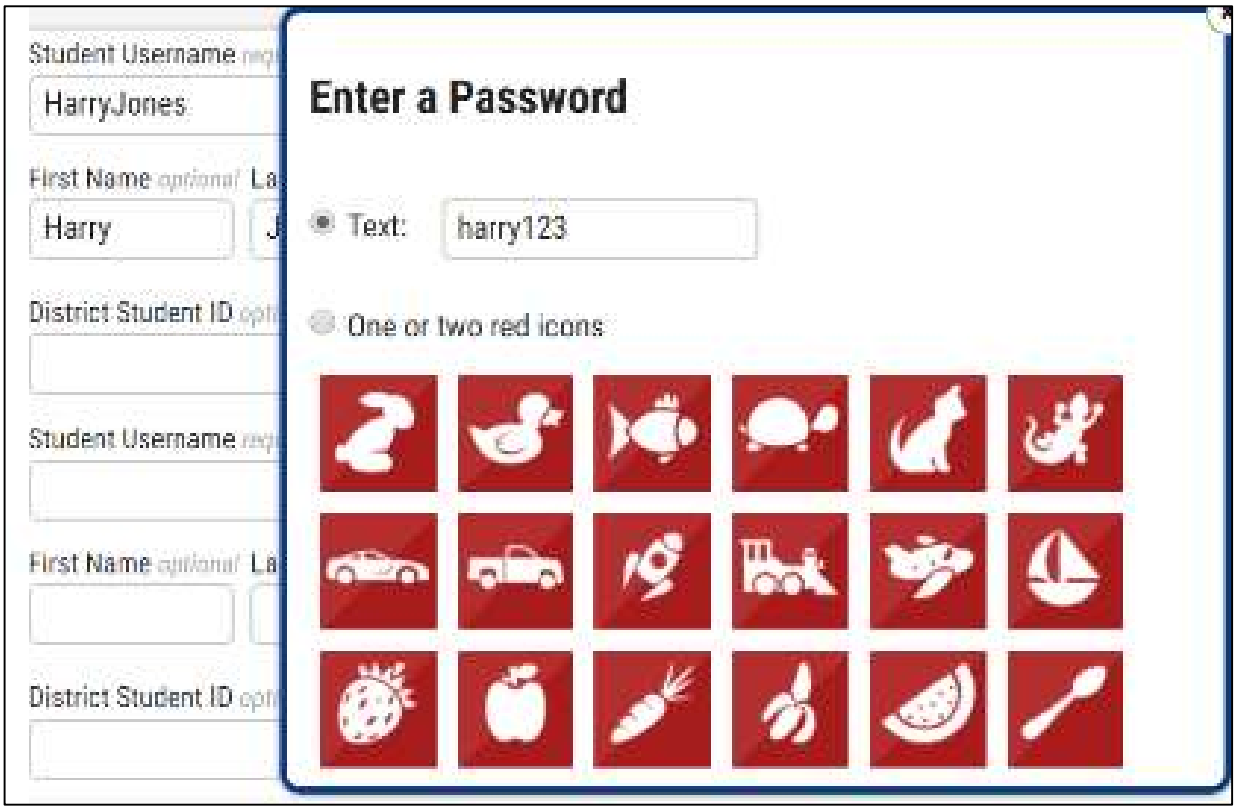
My Classroom

"My Classroom" allows you to see who is in your Headsprout class and what their username and password is, add new students to the programme and restore students that you may have removed from the programme, turn incentive on and off and give access to Sprout stories.



Add students.

Add a new student to your Headsprout class, click on “Add students”, enter their details and give them a password (word or text)

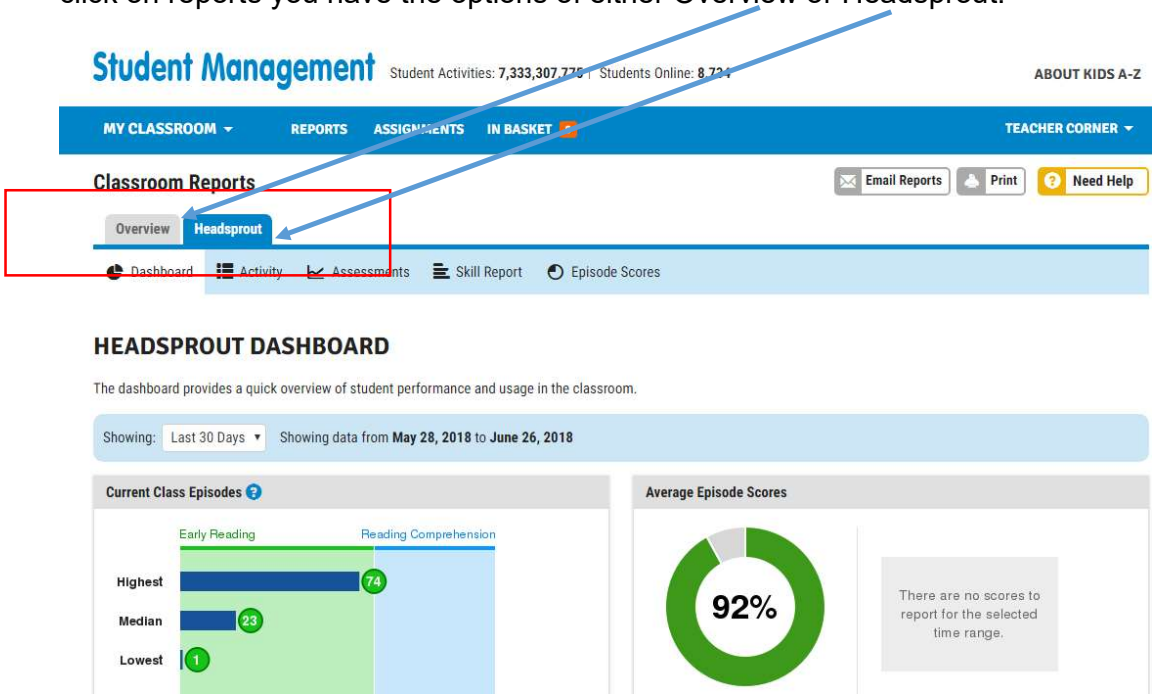


Restore Students.

To restore students that you have taken off the programme, click on restore student and they will appear there, click on the student and then click restore to My Roster. The student will appear back in your roster.

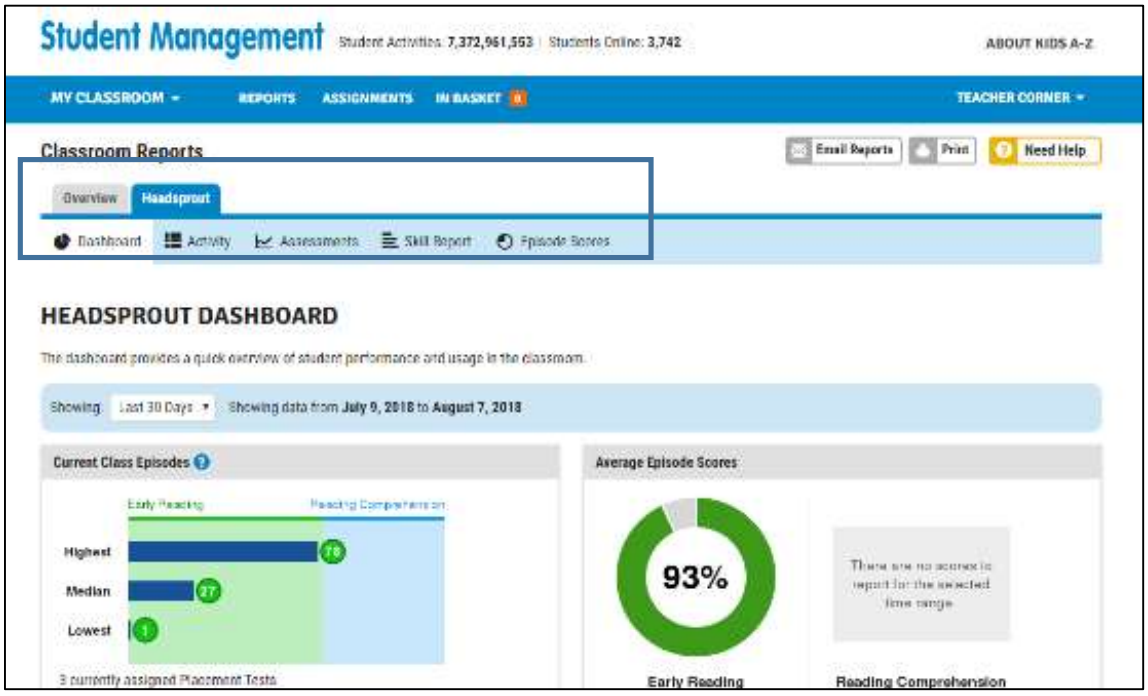
Reports:

The reports section allows you to view progress made by each student. When you click on reports you have the options of either Overview or Headsprout.



NOTE: Overview contains information on the comprehension section which we are not using in this research so click on **Headsprout.**

When you have clicked Headsprout, you have five options to choose from, each of which will provide different information.



Dashboard: The dashboard provides an overview of student performance and usage in the classroom.

Activity: The Activity Report provides information on program usage, including episodes completed, sprout stories read, and benchmarks taken. Select each student then look at what dates range it is showing. Change this to “all” for an overview of everything they have done since they started Headsprout or pick individual weekly periods to see what the student completed in a specific time period.

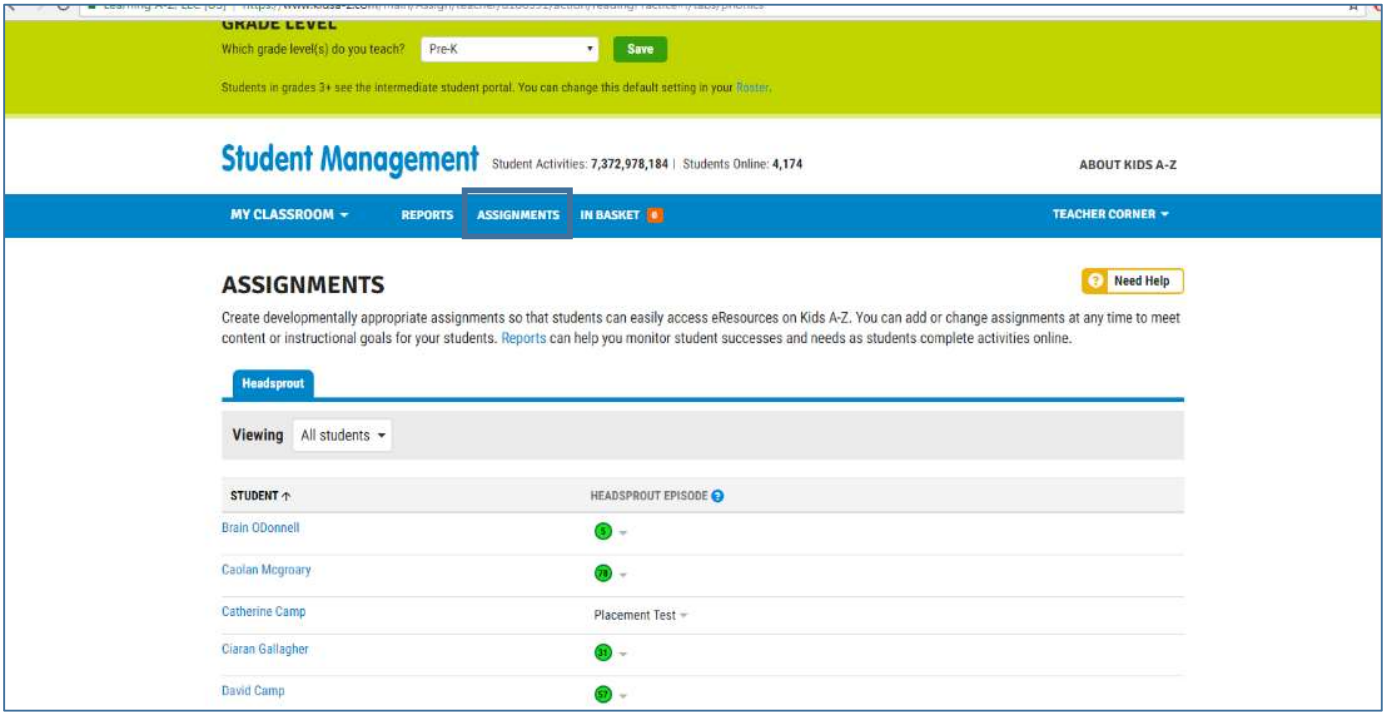
Assessments: The Assessments Report compiles all the results from the Headsprout Early Reading (HER) benchmarks that students take after every 10 episodes.

Skills reports: View student performance by comprehension skill and comprehension strategy in the Skill Report (Note, we will not be using this section as it deals with comprehension rather than phonemic awareness and word recognition)

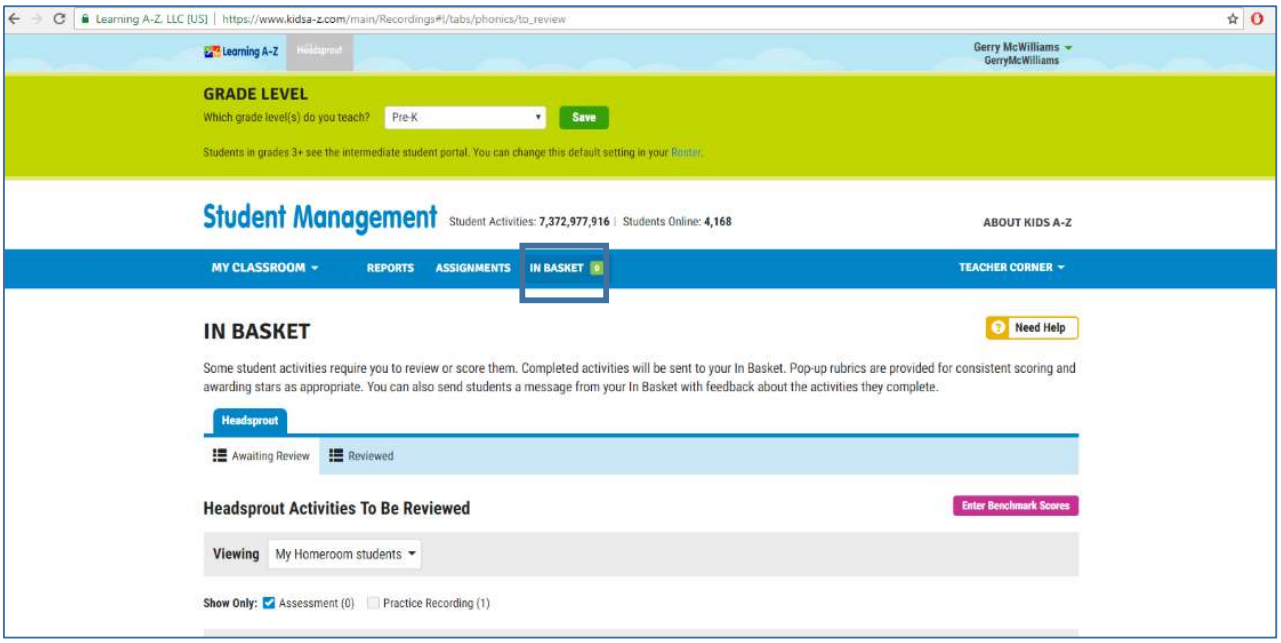
Episode scores: View student progress and performance for the entire classroom with this at-a-glance table.

NOTE: By clicking on pupil names in these section you will have access to individual progress information for each pupil

Assignments

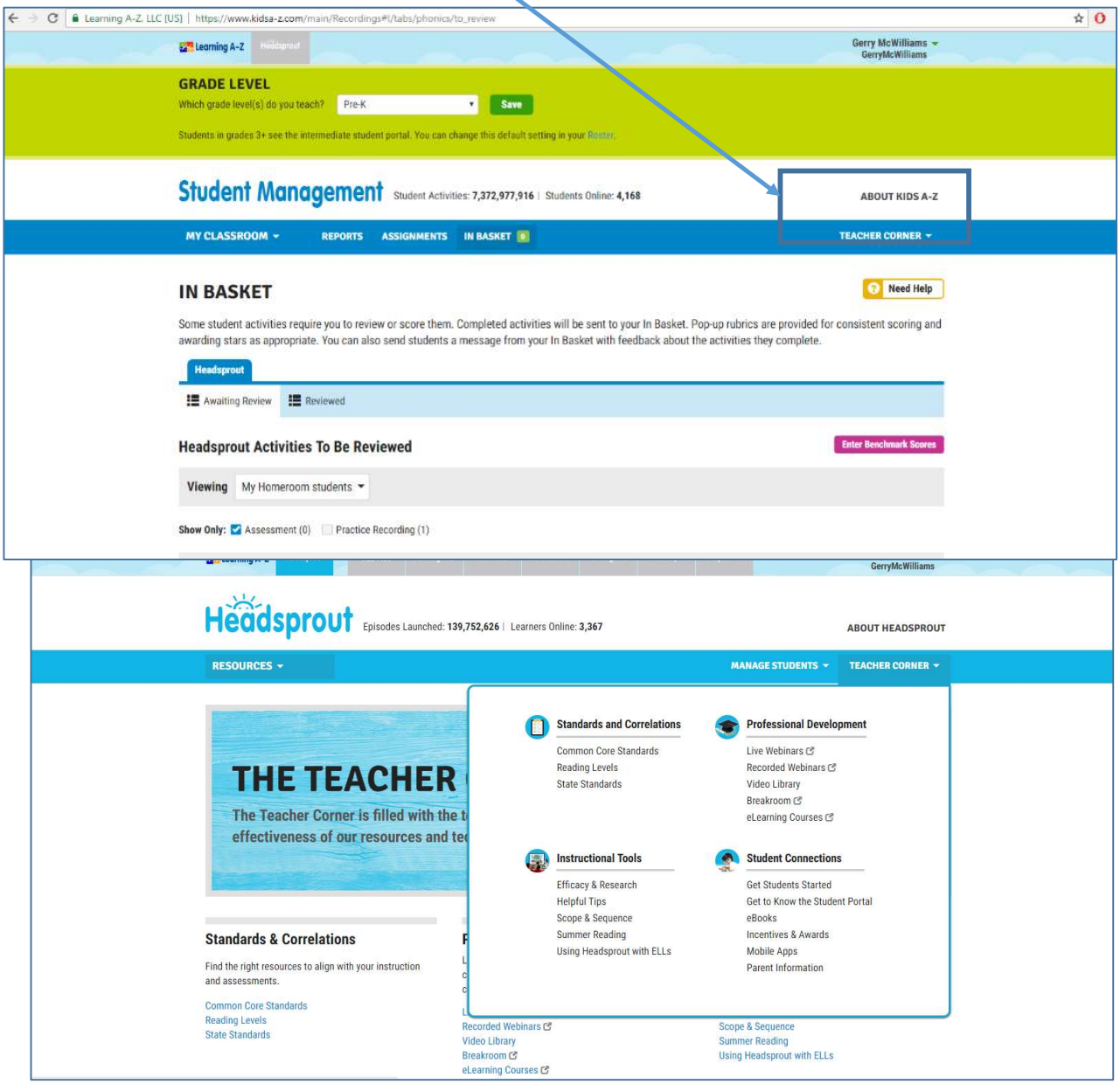


In Basket



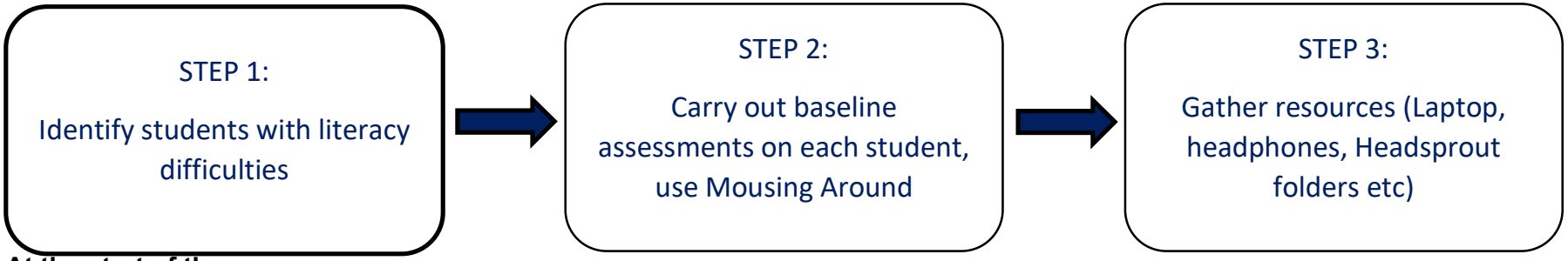
In basket is only used for audio clips sent to you by your students. This is an additional resource not a necessary part of this research project.

Section 3 Teacher's Corner

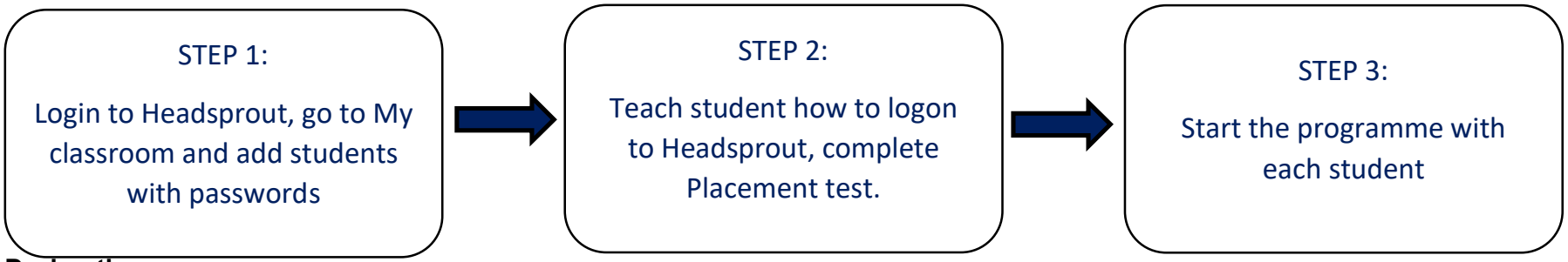


The teacher's corner section contains various tools designed to maximise the effectiveness of the programme. Within it are helpful tips (See the next section), information on which U.S. literacy standards different parts of the programme relate to, programme efficacy and research, support documents that you may find helpful when running the programme and information for parents on the programme.

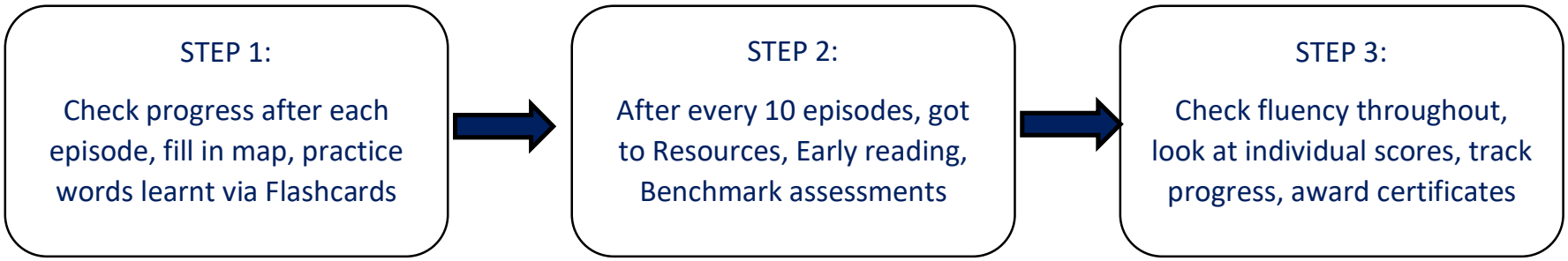
Before the programme:



At the start of the programme:



During the programme:



Helpful tips:

Some tips to help you to get started with Headsprout.

Scheduling
If a student completes an episode and is eager to try another, gauge whether he or she will be successful. Each episode involves many active responses on the part of the student, and it is much better to end an episode wanting more than to attempt a second or third and quit while tired or frustrated. Always take a short break (move around, stretch, get a drink) between any consecutive episodes.

Establish a time for completing Headsprout episodes when your student is free from distractions and when you are available to give help if needed. For best results, an adult should be nearby to listen (intermittently or consistently, as needed) for accurate oral responding while the student completes episodes.

Allocate 30 minutes of computer time for students to complete each episode. Episodes can take as little as 10-20 minutes to complete, but students should be encouraged to learn at their own pace. If there is extra time, students can practice reading stories in the Reading Room.

Set-up
Press the F11 key (at the top of the keyboard) once the program is loaded to maximize the screen image and hide other toolbars.

Move the keyboard behind the computer to minimize distraction (the keyboard is not needed during the program).

Readiness Activities
Conduct the Placement Test prior to beginning Headsprout episodes to ensure students are successful and challenged right away. The placement assessment can be conducted at the start of each new school year.

Implementation
Let the program do the teaching. A key feature of Headsprout is that students can work on the episodes by themselves. Headsprout episodes are designed to teach students without requiring extra help, and will adapt to each student's success or need for more assistance. Give your student the opportunity to succeed on his or her own, but be available to help if necessary.

Instruct students to speak out loud using their "Headsprout voice" when the yellow "smiley face" icon is on the screen. Headsprout uses several techniques to ensure students read out loud, but the program does not use voice recognition.

For best results, students should read all Sprout Stories. Some stories will be presented to students automatically upon completion of episodes while others will become available in the Reading Room.

Use the Sprout Cards that correspond to the block of episodes the student is working on for fluency practice. The Sprout Cards can also be used at home for extra practice.

If a student makes an error while reading a Sprout Story, ensure that the student is attending to the words rather than to the pictures. The student may need to point to the words as he or she reads them.

Student progress is saved automatically throughout program episodes. Adjust the session duration if the student is having attention-related difficulties.

Headsprout episodes don't have a formal pause button; if the student needs to leave the computer during an episode, the program stays at that point and repeats the last instruction until the student returns and makes a response. If an episode is stopped before it is completed, the program will resume at the same spot the next time the student signs in (as long as the student has reached a "checkpoint").

If a student struggles
Headsprout's embedded feedback adapts to students' responses in the online episodes; if a student struggles, wait to see if the embedded feedback solves the problem. If necessary, try imitating or rephrasing the prompts or instructions to let the student know what he or she is being asked to do.

If a student struggles with reading comprehension questions, remind the student to read the question carefully and look back in the passage to find the answer before responding. Ask the student to point to the part of the passage with the answer and explain how what they found in the passage makes them think about the answer to the question.

Special populations
The length of episodes may be too long for some students. Modify the length by having a break halfway through. There is no need to complete an entire episode in one sitting. Start with a length of time that is comfortable for your student, and gradually build the time to a full episode or other duration that works well.

If a student is having difficulty navigating the mouse, have the student point to the screen while someone else moves and clicks the mouse. It is important to ensure that the student is the one choosing the answers.

Repeat an episode or sequence of episodes as often as necessary. Students with special needs may benefit from completing some episodes more than once.

Reports

Spend 10 minutes per week reviewing Headsprout reports to track usage and episode performance data that can help you determine if a student will need intervention or additional practice. Share progress with the student to encourage and celebrate success.

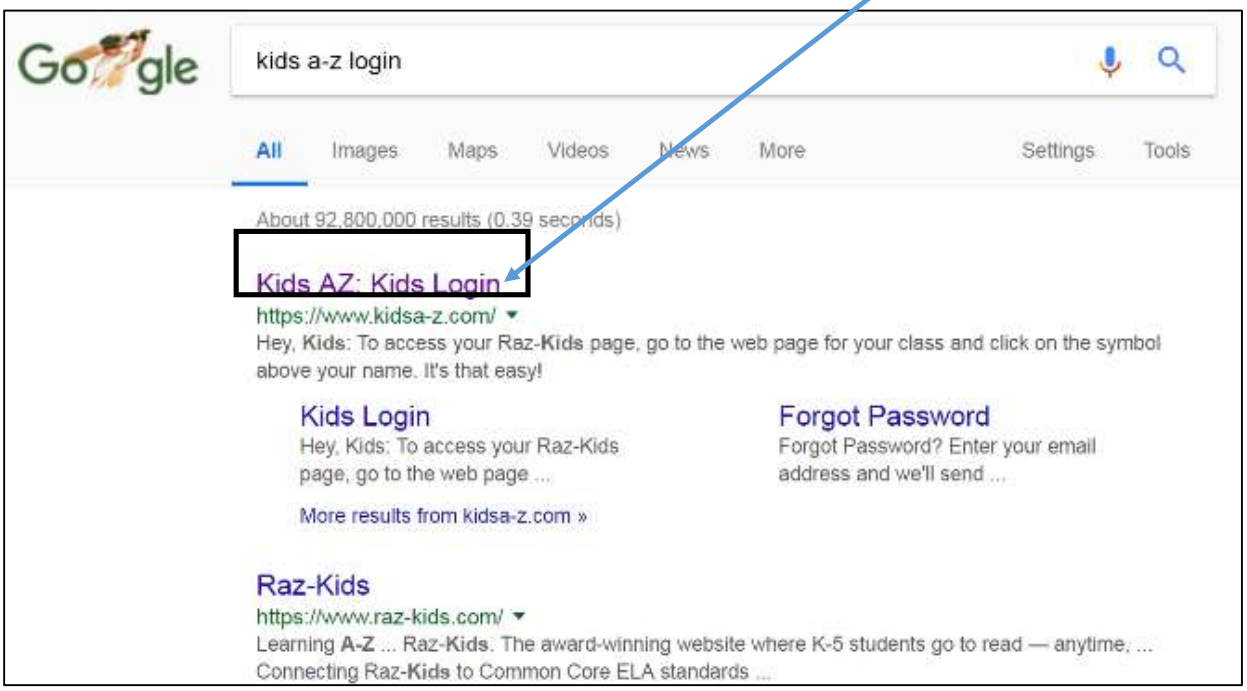
Use the Assessments Report to review how many assessments the student has completed, and which assessments need to be scored.

When students receive two or more scores under 80% in a row, monitor the student more closely to see if the scores were an isolated case or if the student is struggling. Typically, one score under 80% alone is not cause for concern.

Go to Google and type in:

Kids a-z login

click search and this will appear. Click on the link



Find your name. Click on it and then click on your picture.

You are now in Headsprout!

Well Done!!

Appendix 4 FIT Test

Each pupil will complete three FIT assessments, FIT 1, FIT 2 & FIT 3 (See page 277)

Each FIT will last for one minute. A countdown app on a mobile phone will be used to time each assessment. The research assistant will also time the assessment on a second phone as back up.

Flashcards with letter/letters written on them will be shown to each pupil over the one-minute period.

Pupils will be asked to say the sound that the letter(s) on each card make, not the name of the letter.

Correct answers will be placed face down on the table on a pile to the left. Incorrect answers will be placed face down on the table on a pile to the right.

No indication will be given as to whether each answer was correct or incorrect.

At the end of each assessment the assessor will tally and document each score. This will be verified with the research assistant at the end of each one-minute assessment.

FIT 1

an	ee	n	s	v	c	cl
cr	f	fl	fr	l	r	sl
sn	and	ip	p	pl	pr	sp
ish	out	sh	h	ing	old	sw
w	er	st	t	tr	ake	b
bl	br	d	dr	ike	k	m

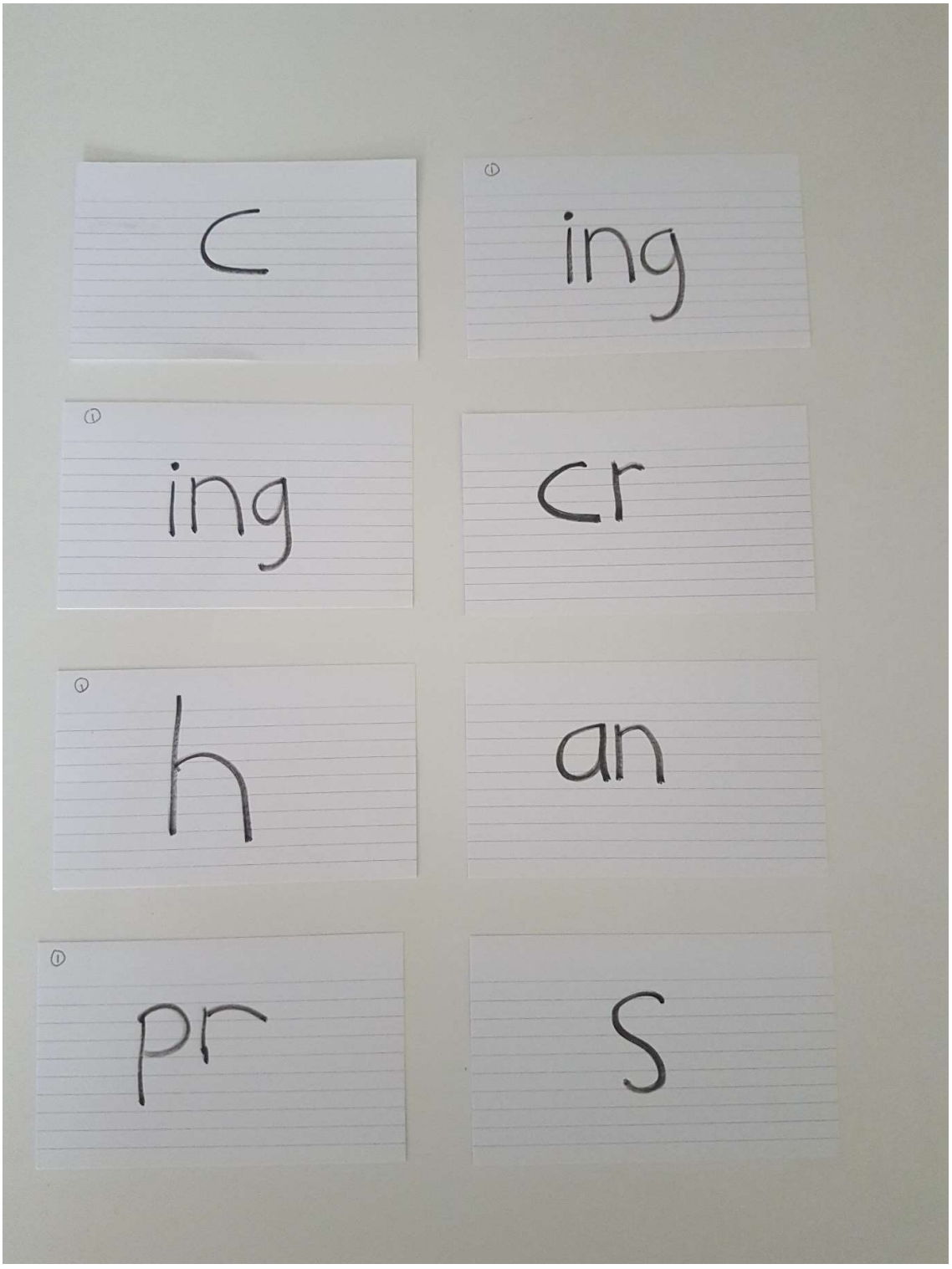
FIT 2

ay	g	gr	ill
im	in	j	good
soon	or	th	thr
um	z	ad	ate
ed	el	en	et
id	ide	ig	it
ot	ox	str	up
us	ut	at	

FIT 3

ace	ack	ai	all
am	ame	ar	as
ch	ea	em	es
est	ew	ex	ick
ife	igh	ime	ind
ine	ir	ire	ix
kn	ock	og	ou
how	snow	qu	spr
uck	ug	un	wh
y			

Sample FIT Cards



Appendix 5 PERA Assessment

As part of the BRBO project, each participating pupil will undergo literacy assessment before, during and after the project.

The assessments used will be as follows:

- Phonics Early Reading Assessment (PERA)
- Flashcard Identification test (FIT)

PERA:

The PEAR compromises two standardised tests which assess pupils' developing knowledge and use of phonics as tools for reading, use of single words, non-words and whole sentences.

Each PERA takes about 10 minutes per pupil and contains 3, 2 sided sheets for pupils to read from and point to.

PERA will provide a **Sentence Reading Age** and a **Phonics Reading Age.**

Sentence Reading Test:

50 counted words to be read aloud by the pupil. When/if they reach their 5th error, the test stops. The reading age at that word is their sentence reading age.

Phonics Test (3 parts):

Part 1: read single words aloud from one side of a card

Part 2: Pronouncing non words from the other side of the card

Part 3: Recognising and pointing to words and non-words amongst suitable distractors (words that look like each other)

There is a pupil's record sheet for each part of the test to record their responses and score.

Pera 1A

Is the cat sad?

Did the dog and
the duck sit on a sack?

Has the king got a fish?

SENTENCE READING

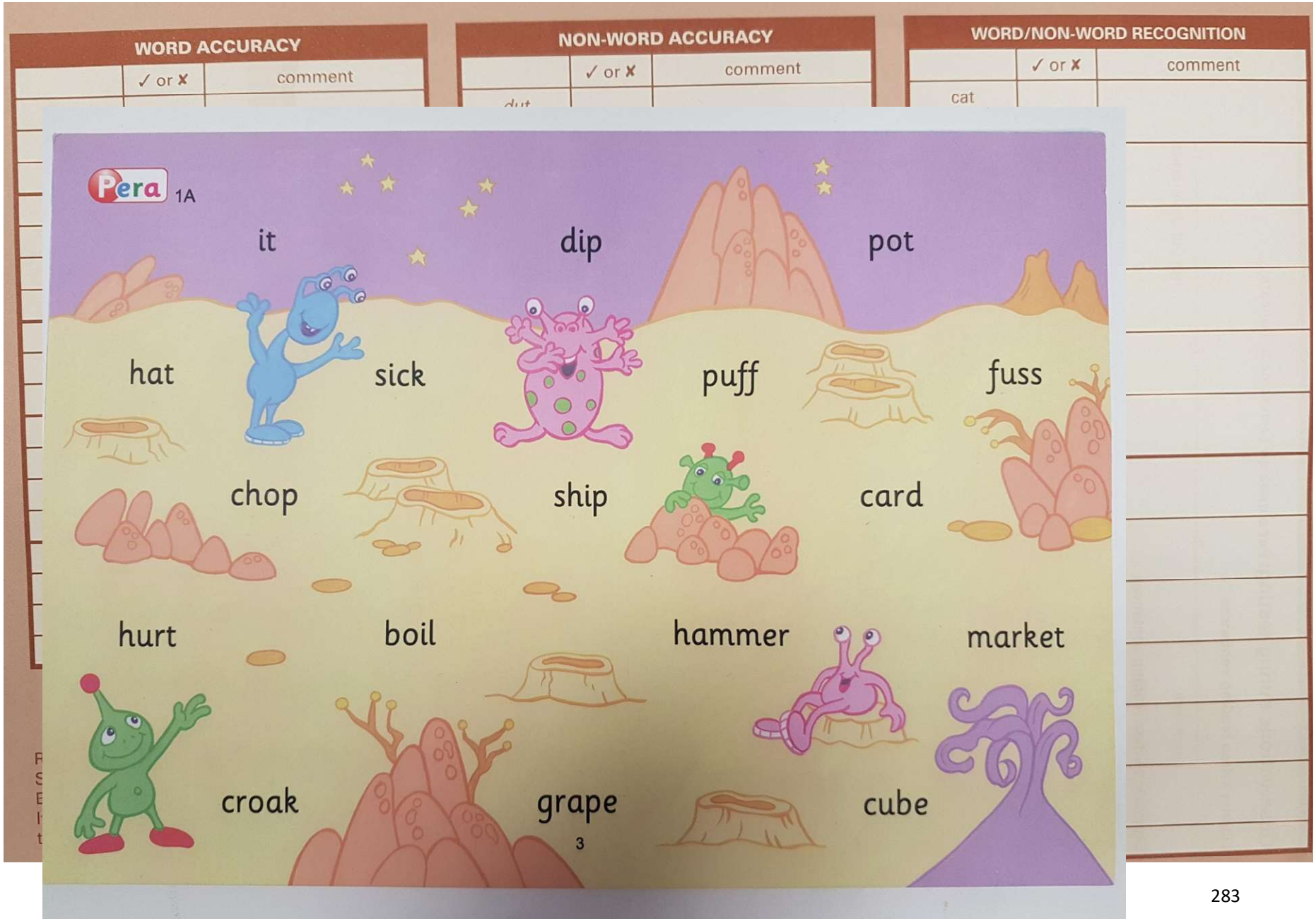
main L

1	1 Is	2 the	3 cat	4 sad?			
2	5 Did 4:6	the	6 dog 4:7	7 and 4:7			
	the	8 duck 4:8	9 sit 4:9	10 on 4:9	11 a 4:9	12 sack? 4:10	
3	13 Has 4:11	the	14 king 5:0	15 got 5:0	a	16 fish? 5:1	
4	17 Wait 5:2	18 for 5:2	the	19 light 5:3	20 from 5:3	the	21 moon. 5:4
	22 My 5:4	23 big 5:5	24 sister 5:6	is	25 under 5:7	the	26 tree 5:8
	27 near 5:8	the	28 church. 5:9	29 Can 5:9	30 you 5:10	31 see 5:10	32 her? 5:11
5	33 I 6:0	34 live 6:1	35 in 6:1	a	36 little 6:2	37 white 6:2	38 house 6:3
	in	a	39 park. 6:4				
	40 It 6:4	has	a	41 red 6:5	42 roof. 6:6		
	43 There 6:6	44 are 6:6	45 flowers 6:6	and	46 chickens 6:6+	in	
	the	47 garden. 6:6+					
	The	48 sheep 6:6+	are	49 outside 6:6+	the	50 fence. 6:6+	

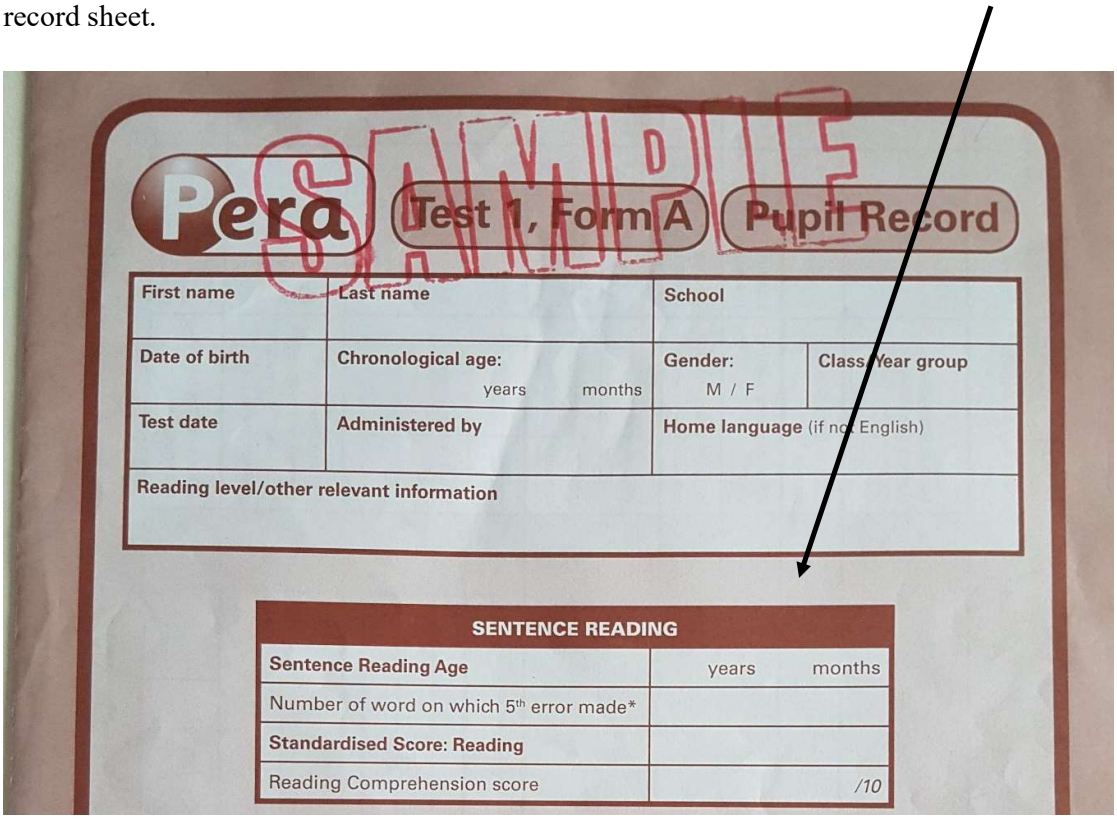
ecord errors in the text above. Note any miscues, self-corrections, or unusual features of the pupil's reading or responses in the spa
he reading age associated with children who made their **5th error** at this word is shown below each word. Ignore all greyed out 'non-
number precedes each 'counted' word: use this number for the **5th error** word to look up the standardised score. ONLY ask a compre
ewer errors in that sentence. When pupils give a partial answer to a comprehension question, prompt neutrally to encourage a more
Sounds, of the words in the sentence is shown in the central column.


Pera 1A
it
dip
pot
hat
sick
puff
fuss
chop
ship
card
hurt
boil
hammer
market
croak
grape
cube
3

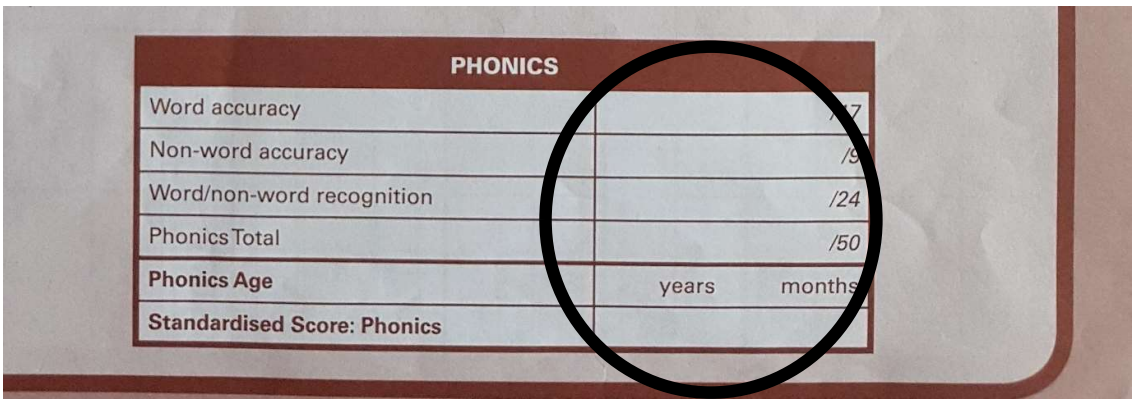

Pera 1A
dut
biss
gock
pait
vight
zood
prown
birl
horb
ISBN 978 1 444 14891 6 (set of 6 cards) Copyright © 2011 Hodder & Stoughton Ltd.


WORD ACCURACY
✓ or ✘
comment
NON-WORD ACCURACY
✓ or ✘
comment
WORD/NON-WORD RECOGNITION
✓ or ✘
comment
cat
Pera 1A
it
dip
pot
hat
sick
puff
fuss
chop
ship
card
hurt
boil
hammer
market
croak
grape
cube
3

Step 1: Have the pupil read the words from the coloured card aloud. When they reach their 5th error, circle that word on their individual pupil record from. *****Remember, don't count the blackout words on the form such as "the" and "is". Write this age at the front of the pupil's record sheet.



Step 2: Ask the pupil to read aloud each of the 17 words, 9 non words and the 24 word recognition words from the cards. Total then write their scores at the bottom of the pupil record sheet.



The next step is to get the pupils phonics age. To do this, get the total score they achieved out of 50 and look it up on the chart on page 22 (Picture below)

For example, if a pupil scored 23, their phonics age is 5:2 (5 years and 2 months)

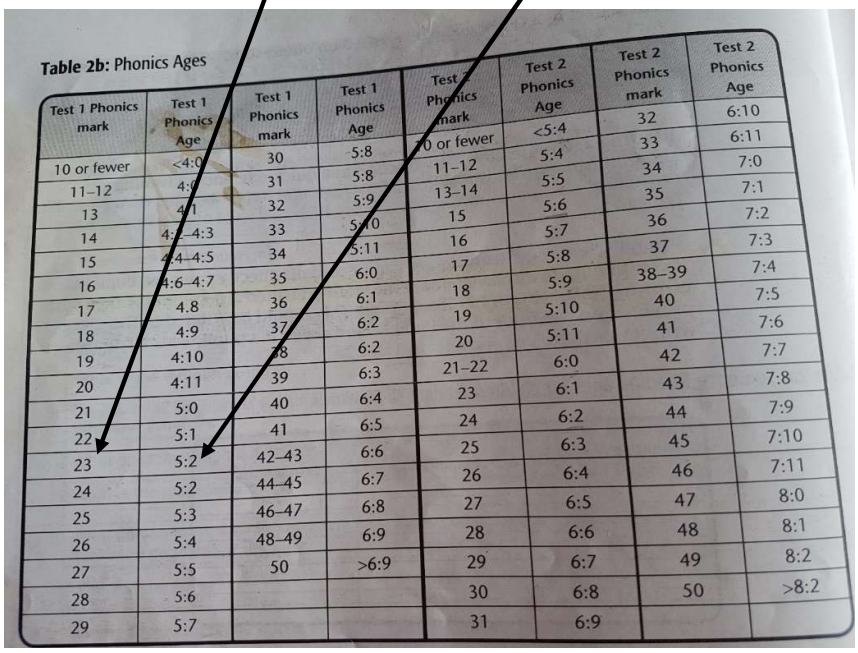
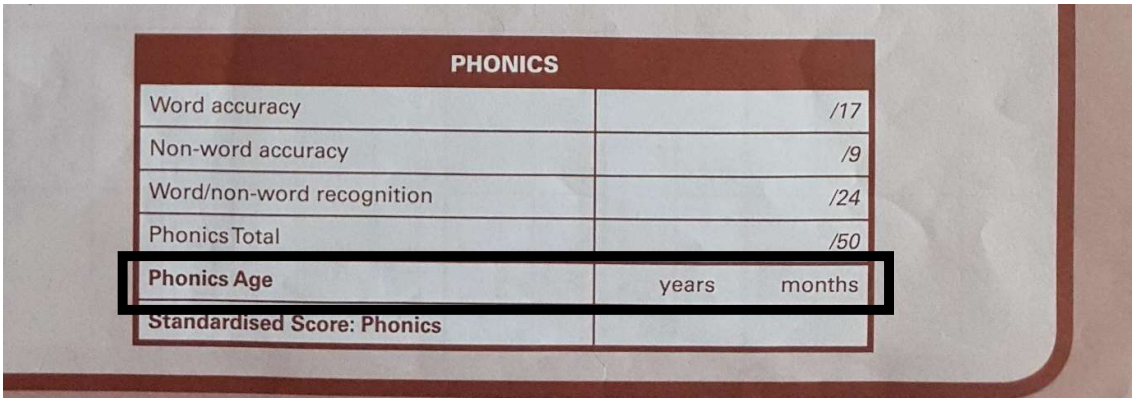


Table 2b: Phonics Ages

Test 1 Phonics mark	Test 1 Phonics Age	Test 1 Phonics mark	Test 1 Phonics Age	Test 2 Phonics mark	Test 2 Phonics Age	Test 2 Phonics mark	Test 2 Phonics Age
10 or fewer	<4:0	30	5:8	10 or fewer	<5:4	32	6:10
11–12	4:0	31	5:8	11–12	5:4	33	6:11
13	4:1	32	5:9	13–14	5:5	34	7:0
14	4:2–4:3	33	5:10	15	5:6	35	7:1
15	4:4–4:5	34	5:11	16	5:7	36	7:2
16	4:6–4:7	35	6:0	17	5:8	37	7:3
17	4.8	36	6:1	18	5:9	38–39	7:4
18	4:9	37	6:2	19	5:10	40	7:5
19	4:10	38	6:2	20	5:11	41	7:6
20	4:11	39	6:3	21–22	6:0	42	7:7
21	5:0	40	6:4	23	6:1	43	7:8
22	5:1	41	6:5	24	6:2	44	7:9
23	5:2	42–43	6:6	25	6:3	45	7:10
24	5:2	44–45	6:7	26	6:4	46	7:11
25	5:3	46–47	6:8	27	6:5	47	8:0
26	5:4	48–49	6:9	28	6:6	48	8:1
27	5:5	50	>6:9	29	6:7	49	8:2
28	5:6			30	6:8	50	>8:2
29	5:7			31	6:9		

When you have the phonics age, write it on the front of the Pupil record sheet:



PHONICS		
Word accuracy	/17	
Non-word accuracy	/9	
Word/non-word recognition	/24	
Phonics Total	/50	
Phonics Age	years	months
Standardised Score: Phonics		

The PERA assessments are complete. You now have a sentence reading age and a phonics reading age for the pupil.

Appendix 6-Questionnaire

Thank you for taking time to complete this questionnaire, this is an important aspect of the research.

The information you provide in this questionnaire will be treated in confidence.

All schools, staff and pupils have been anonymised as part of this study.

School Name:

Teacher Name(s):

Please return this questionnaire to:

Gerry McWilliams

c/o Dr. Claire McDowell

School of Psychology

Ulster University

Cromore Road

Coleraine

Please answer the following questions as honesty as possible. Your feedback is very important to our research. Thank you so much for your time!

Q1. How easy/difficult was it to have pupils complete 3/4 episodes of Headsprout per week?

0	1	2	3	4	5	6	7	8	9	10

Extremely easy Extremely difficult

Comment:

Q2. What difference would better technology have made to the ability to use Headsprout 3/4 times per week i.e. more computers, Laptops, IPads

0	1	2	3	4	5	6	7	8	9	10

No difference Major difference

Comment:

Q3. What difference would use of an external support person to run Headsprout with your pupils have made to how many episodes pupils completed?

0	1	2	3	4	5	6	7	8	9	10

No difference Major difference

Comment:

Q4. Would it have made a difference if Headsprout was done part of the whole class curriculum as opposed to in addition to it?

0	1	2	3	4	5	6	7	8	9	10

No Difference Major difference

Comment:

Q5. How many episodes of Headsprout do you think is realistic to complete per week?

0	1	2	3	4	5	6	7	8	9	10+

Comment:

Q6. What negative impact did technical glitches such as the screen "freezing" have on running Headsprout?

0	1	2	3	4	5	6	7	8	9	10
No impact										Major impact

Comment:

Q7. How do you feel your students enjoyed using Headsprout?

0	1	2	3	4	5	6	7	8	9	10
Didn't like it										Liked it a lot

Comment:

Q8. What level of positive impact do you feel Headsprout has had on pupil's literacy?

0	1	2	3	4	5	6	7	8	9	10
No impact										Major impact

Comment:

Q9- Please rank the following in order of relevance, **with 1 being most relevant/important and 8 being the least relevant/important**

A major difficulty in running Headsprout at least 3 times week was:

- Available time in the school day ☐
- Access to PCs, laptops, tablet etc. ☐
- Access to appropriate space ☐
- Staff time supervising sessions ☐
- Pupil reluctance to engage ☐
- Pupil difficulty completing the program ☐
- Lack of buy in/support from other staff ☐
- Poor Wi-Fi/ Internet signal ☐

Q10- Please rank the following in order of relevance, **with 1 being most relevant/important and 6 being the least relevant/important.**

A positive to running Headsprout in the school was:

- Pupils enjoyed using it ☐
- Pupil's confidence in reading improved ☐
- Pupils literacy skills improved ☐
- It was easy to run ☐
- It was efficient and effective in relation to time & outcomes ☐
- Pupils engaged more in class ☐

Q11. If you were involved in this project again, what would you do differently when running Headsprout?

Q12. If there is anything else you think would be useful to the research team regarding the running of the Headsprout program in schools, please lets us know here:

Thank you for your feedback and support throughout this project. We hope the data we have collected can help improve the literacy of children in N. Ireland. You have played your part and we thank you sincerely for that.